THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1829.] LONDON, MAY 31, 1898. [50TH YEAR. PRICE 6d.

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FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

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FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
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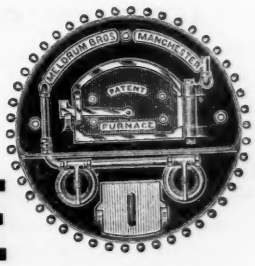
BREEZE FURNACE



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Also at LONDON, LEEDS, LIVERPOOL, BIRMINGHAM, NEWCASTLE, and GLASGOW.
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Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

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GAS-WASHERS

OF ALL SIZES,

PROVIDED WITH

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FOR INCREASING OR DECREASING SEALS AT WILL.

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Made in all Sizes to suit any available space.

IN ASKING FOR PRICES, PLEASE STATE MAXIMUM MAKE OF GAS PER 24 HOURS.

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SPECIAL ATTENTION GIVEN TO SHIPPING ORDERS.

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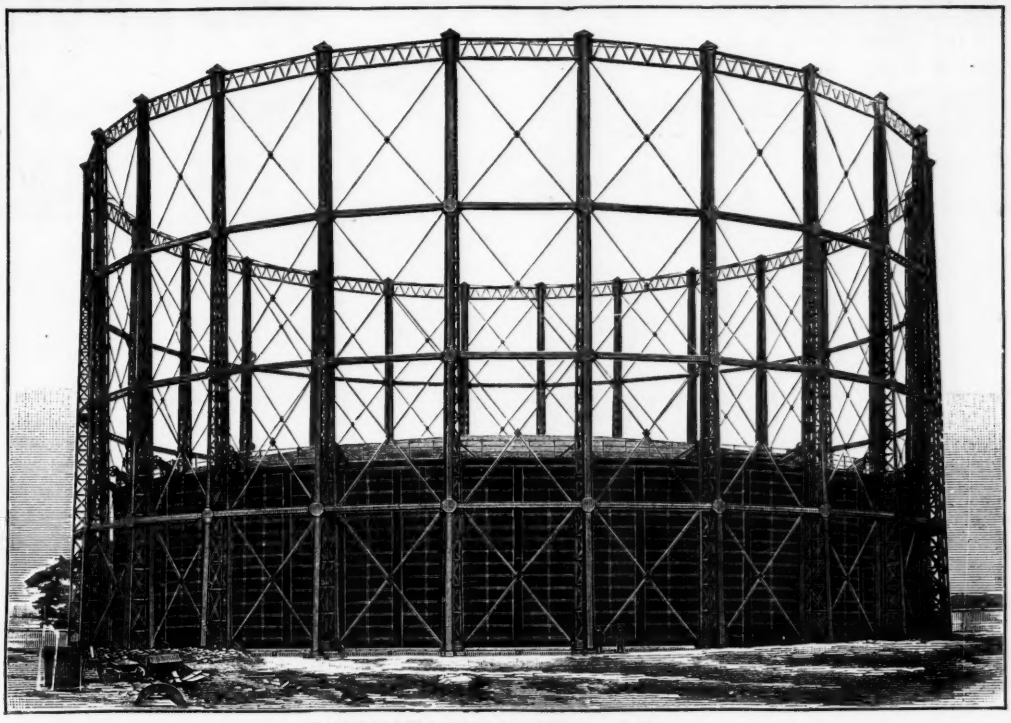

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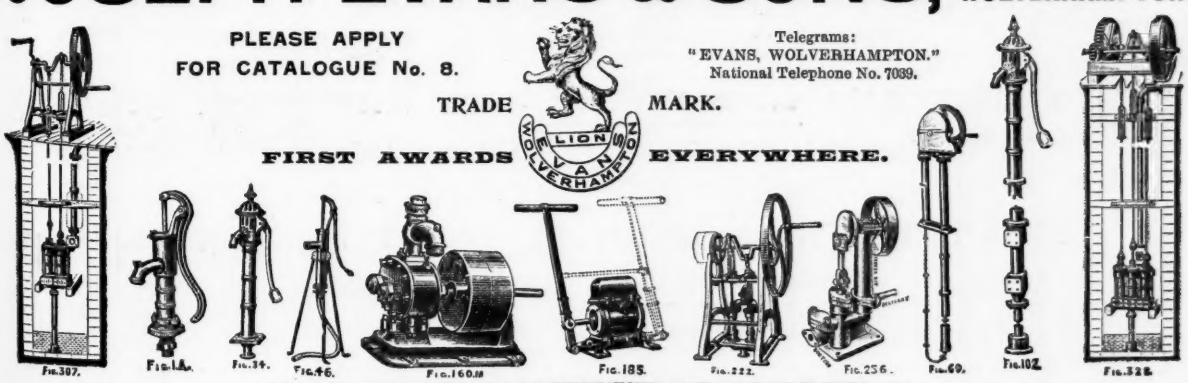

Fig.307. Fig.1A. Fig.39. Fig.46. Fig.160.M Fig.185. Fig.222. Fig.236. Fig.69. Fig.102. Fig.328.

SEE NEXT WEEK'S ADVERTISEMENTS FOR STEAM-PUMPS, &c.

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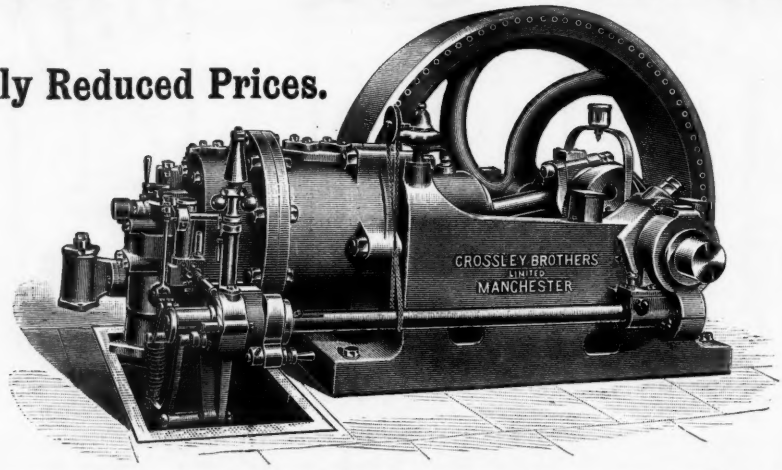
Greatly Reduced Prices.



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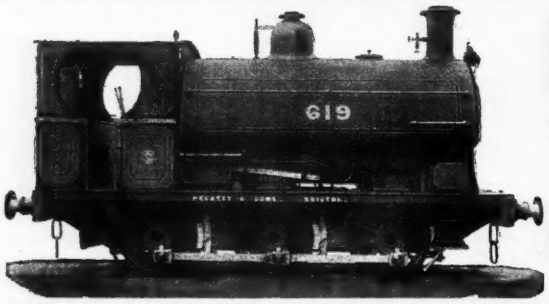

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RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

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PURIFIERS with Planed Joints a Speciality.

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OIL FOR GAS MAKING

PURE DISTILLATE.

HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

CAN BE STORED SAFELY ANYWHERE.

FLASH POINT GUARANTEED OVER 200° FAHR.

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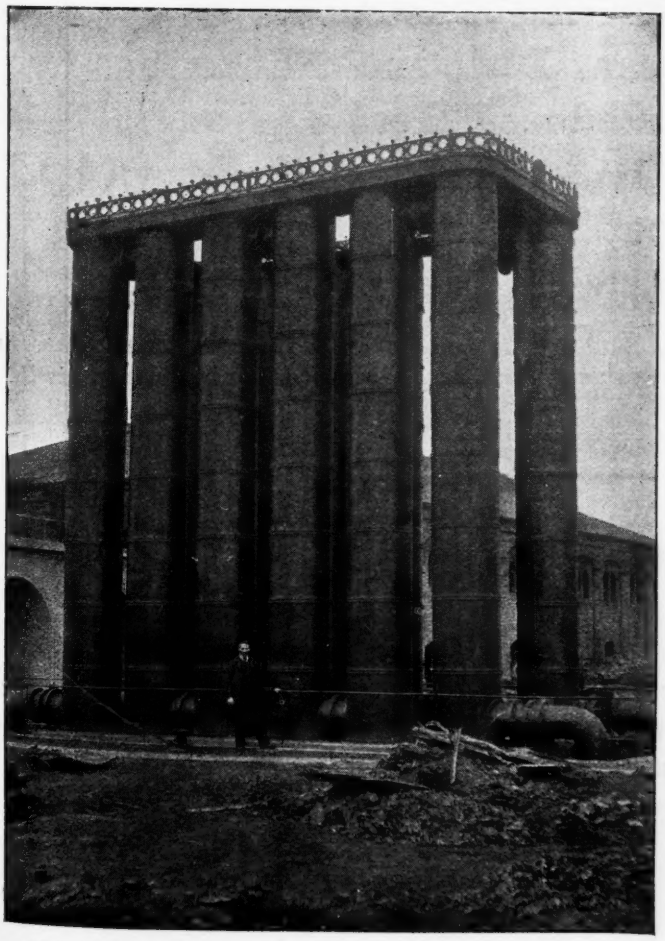

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Gas Plant and Structural Ironwork of every description.

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THE GREATLY REDUCED CONSUMPTION OF GAS COVERS THE INITIAL COST OF THE BURNER IN LESS THAN SIX MONTHS.

The Ordinary "C" Burner,
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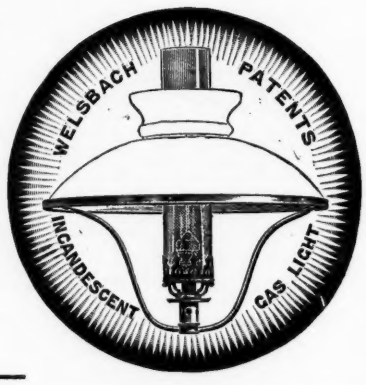
Prices of other Patterns Reduced Proportionately.



The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to **Popularize the Use of Gas** as an Illuminant, owing to the following Advantages :—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.
Freedom from Smoke, Dirt, and Flickering.
Greatly Reduced Heat.
The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The "Lancet" Special Analytical and Sanitary Commission, in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the **Healthiest, Best, and most Economical System of Gas Lighting.**

Suitable for every purpose of **Inside and Outside Lighting.**

Avoid the WORTHLESS IMITATIONS now being offered by UNSCRUPULOUS INFRINGERS.

OVER ONE HUNDRED AND FIFTY JUDGMENTS

and Interim Injunctions recently obtained against Companies, Firms, and Persons INFRINGING THE "WELSBACH" PATENTS, or INFRINGING THE LIMITED LICENSE under which the Mantles are sold.

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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AND

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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.

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THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., LD.

QUAYSIDE, NEWCASTLE-ON-TYNE.

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FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

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TUBES AND FITTINGS

ALL KINDS

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

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STEEL OF ALL DESCRIPTIONS.

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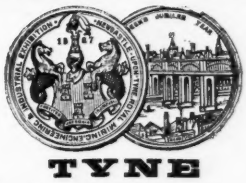

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·38 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per ce .

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

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COAL OWNERS, NEWCASTLE-ON-TYNE;

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E. FOSTER & CO.,

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WELLS' LIGHTNING PAINTER

LIME AND COLOUR WASHER.

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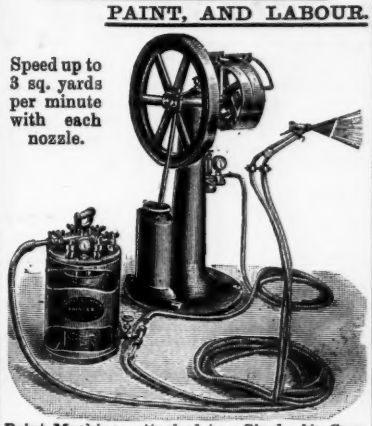
PAINTING BY MACHINE.

GREAT SAVING IN TIME, PAINT, AND LABOUR.

Speed up to 3 sq. yards per minute with each nozzle.



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(OVER 1 SQUARE YARD PER MINUTE.)

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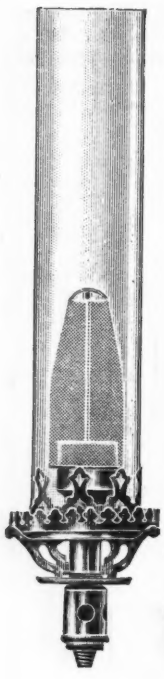
NEW POPULAR PRICES.

BURNERS



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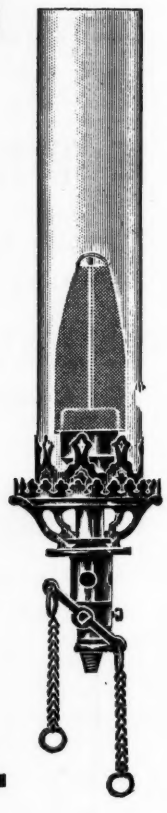
3/10 each.

WITH BYE-PASS, 5/-.

MANTLES

per 9/- doz.



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SUNLIGHT MANTLES

PRODUCE A DIFFUSED LIGHT OF SOFT RAYS,

The NEAREST APPROACH to the LIGHT of the SUN.

Price Lists, &c., on application.

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SUITABLE FOR WORKS OF EVERY CAPACITY,

AND A SPECIAL FORM OF WHICH IS APPLICABLE TO

GASEOUS FIRING WITH A MINIMUM EXCAVATION.

RETORT-BENCH IRONWORK, CONDENSERS, SCRUBBERS, PURIFIERS, VALVES, &c.

DESIGNS AND ESTIMATES ON APPLICATION.

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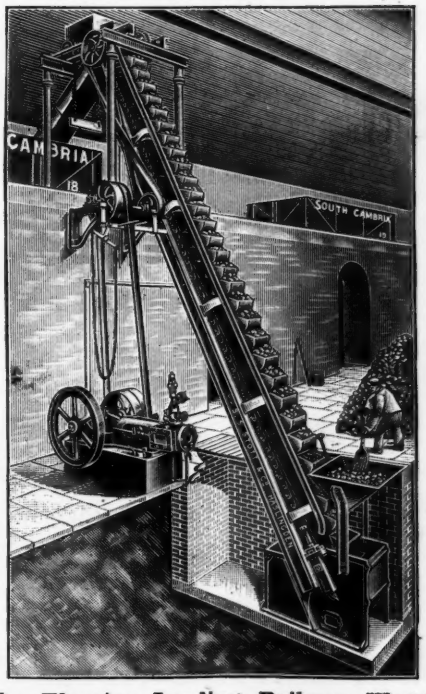

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HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.

PUMPS, HORIZONTAL AND VERTICAL, SINGLE, DOUBLE, or THREE-THROW, for WATER-WORKS, &c.

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WE GUARANTEE RESULTS.

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We shall be pleased to furnish Designs and Estimates on application.

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PREPAYMENT GAS-METER

FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
3. Impossibility of being tampered with.
4. Unaffected by irregularities in shape or thickness of the penny.
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7. Price Changer can be altered without otherwise disturbing the Meter.
8. Index showing number of Pennies in the mechanism at any time.
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GUARANTEED FOR FIVE YEARS.

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SOUTHEND.	PLYMOUTH.	SOUTHEND.
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OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

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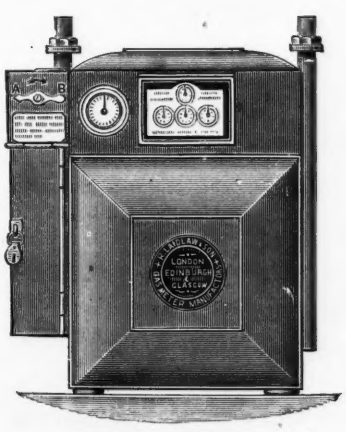

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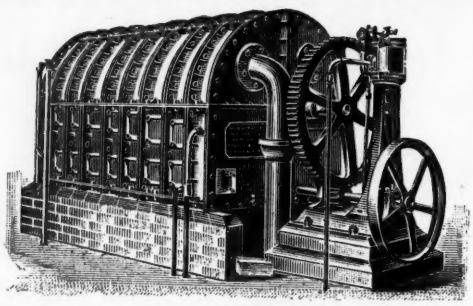

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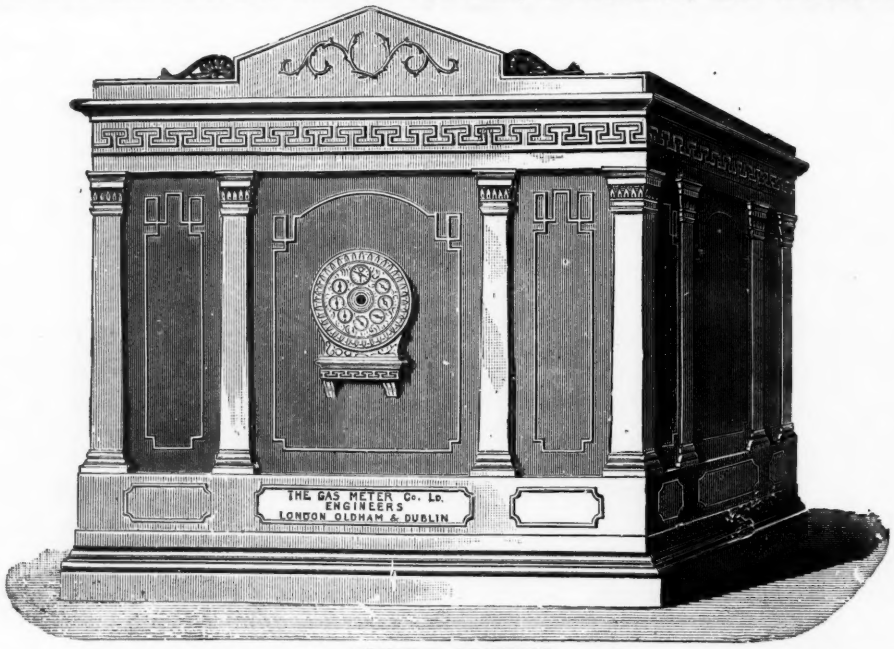

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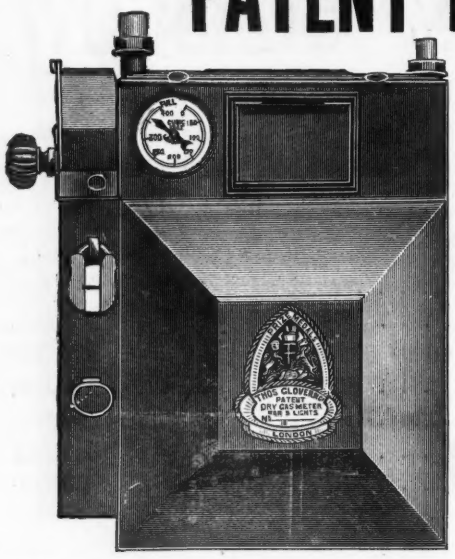

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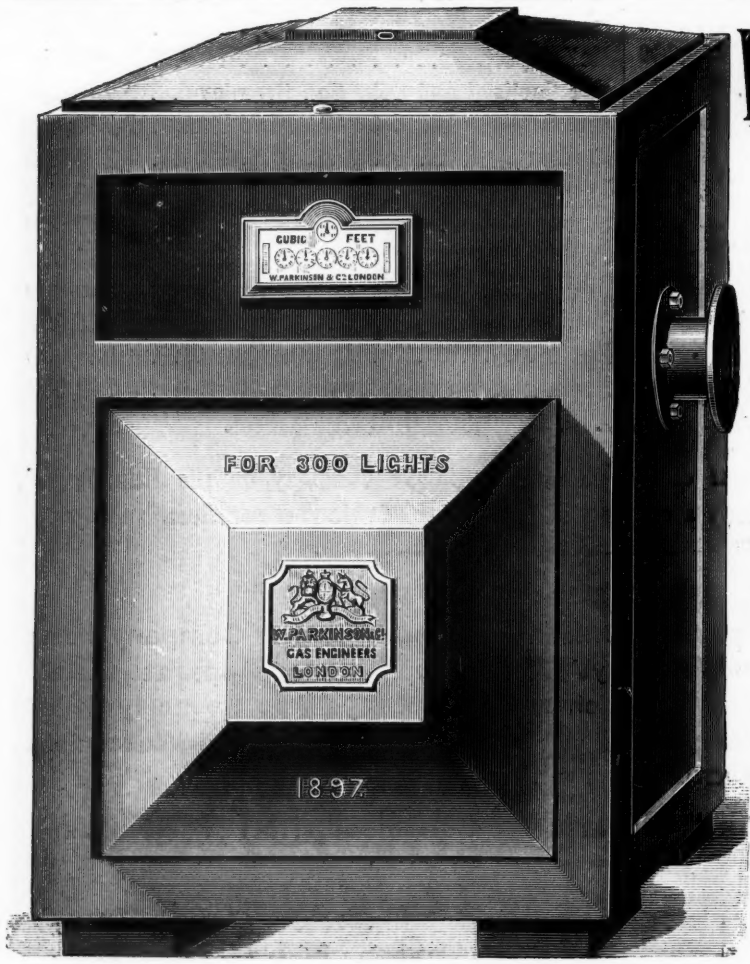

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[See also Advt. p. 1288.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The Meeting of the Institution of Gas Engineers 1243
The Programme of the Meeting of The Gas Institute 1243
The New Instructions of the Metropolitan Gas Referees . . . 1244
The Agitation against The Gaslight and Coke Company . . . 1244
A Vindication of Coke-Breeze Concrete 1244
The Approaching End of the Welsh Colliers' Strike 1245

WATER AND SANITARY AFFAIRS—

The Progress of the Metropolitan Water Inquiry—The London County Council and the Commission 1245
The Annual Meeting of the British Association of Water-Works Engineers 1246

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1246
Electric Lighting Memoranda 1246
Boulnois on Municipal Engineering 1247

NOTES:—

Chemical Tests for Carbonic Oxide 1249
The Thermophone in Use 1249
The Needs of Road Motor Carriages 1249
Fuel in American Iron-Works 1249
The Liquefaction of Hydrogen and Helium 1249

COMMUNICATED ARTICLES:—

Complete and Continuous Purification of Coal Gas in Closed Vessels without Nuisance. By Ernest J. Sutcliffe 1249
The Three-Lift Gasholder at Sutton. By F. S. Cripps 1251

TECHNICAL RECORD:—

The Institution of Gas Engineers—Programme of the Forthcoming General Meeting 1252
The Incorporated Gas Institute—Programme of the Forthcoming Annual Meeting in Belfast 1252
The Revised Instructions of the Metropolitan Gas Referees . . 1252
British Association of Water-Works Engineers—Annual Meeting at Southampton 1260
The Protection of Underground Water Supplies 1262

REGISTER OF PATENTS:—

Generating Acetylene—Patterson, J. J. 1263
Incandescent Gas-Burners—Bartlett, F. G. 1263
Coin-Freed Gas-Meter—Glover, R. T. & J. G. 1263
Patent Notices 1264

CORRESPONDENCE:—

Sunday Labour in Gas-Works (Dr. Gritton's Fund) 1265

PARLIAMENTARY INTELLIGENCE:—

Progress of Bills 1265

LEGAL INTELLIGENCE:—

High Court of Justice—Chancery Division—Barton *v.* Beal and Others; Mains under Private Roads 1265
High Court of Justice—Queen's Bench Division—Horn *v.* Sleaford Union and Others 1265
North London Police Court—Charge of Stealing Gas 1265

MISCELLANEOUS:—

The Gaslight and Coke Company and their Consumers—The Agitation against the Increase in the Price of Gas 1266
Stafford Corporation Gas and Electricity Supply—The Past Year's Working 1266
Lancaster Corporation Gas Supply—The Past Year's Working . 1267
Meeting of the Monte Video Gas Company, Limited 1267
The Gas Undertakings of New Zealand 1268
Electric Lighting Notes 1268
Metropolitan Water Supply Commission—Twenty-third Day . . 1269
Gas and Water Companies' Stock and Share List 1270
The Local Government Board and the Protection of Sources of Water Supply—Proposed General Legislation 1271
Notes from Scotland 1272
Current Sales of Gas Products 1274
Coal Trade Reports 1274

PARAGRAPHS:—

PERSONAL: Mr. Walter Horswell; Mr. T. W. Cairncross; Mr. Thomas Goulden; Professor Robert Wilhelm Bunsen; Mr. Charles Watson 1248
OBITUARY: Mr. W. Green; Mr. Robert Wallis 1248
Molecular Weights of Gases 1247
The New Water Supply of Paris—Society of Engineers . . . 1248
River Plate Gas Company, Limited 1263
Water Supply for Crich—Projected Improvements at the Goole Gas-Works 1264
Middleton Corporation Gas Supply—New Joint-Stock Companies 1265
Increased Storage at the Bridlington Gas-Works 1267
The London County Council and the Water Commission—Sales of Shares 1268

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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Meeting of the Institution of Gas Engineers.

THE official programme is issued of the forthcoming meeting of the Institution of Gas Engineers, and it is now in the members' hands. The meeting will begin on Tuesday, the 14th prox., at the Royal United Service Institution, Whitehall, under the presidency of Mr. G. E. Stevenson, the Chief Gas Engineer to the Manchester Corporation. Two days will be devoted to the reading and discussion of papers; and the third day will be appropriated to the reception of the members of the Institution of Dutch Gas Engineers, who will be taken on a river trip to Beckton and the East Greenwich Gas-Works, and be finally entertained at a banquet at the Crystal Palace. The annual dinner of the Institution will take place on the Tuesday evening, at the Trocadero Restaurant. On the conclusion of the regular work of Wednesday, the meeting will be made special for the purpose of altering the Articles of Association, in order to provide for the appointment of an Honorary Secretary, and also of making provision for the investment of the surplus funds of the Institution. On Friday the members of the Dutch Association are to be taken to Beckton by train, and will spend the day in going through the works. On Saturday the visitors will be conducted in parties to such sights of London as they may desire to see. Nothing seems to be lacking in all this to make the meeting a signal success. We are desired by the Secretary, Mr. Thomas Cole (who has kindly furnished us with an early copy of the programme) to draw the attention of those members who intend to take part in the discussions to the notification of the Council's desire that these proceedings should be as complete as it is possible by previous preparation to make them. The following are the subjects of the papers set down for reading. On the first day, "High-" Pressure Systems of Distribution," by Mr. Fletcher W. Stevenson; "Inclined Retorts," by Mr. E. Drory; "A Modern Gas-Works," by Mr. F. D. Marshall. On the Wednesday, four papers will be taken: "On a Standard " Ten-Candle Lamp," by Professor A. G. Vernon Harcourt; " The Two-Candle Standard," by Mr. E. L. Pryce; "A " New Departure in Carbonizing," by Mr. S. Glover; and " Washers and Scrubbers," by Mr. E. A. Harman. All these titles are of good promise; and the Council are to be congratulated on the arrangements they have been able to make for the excursion and for the entertainment of the Dutch visitors. It only remains for the members generally to attend in sufficient numbers to properly support the President and Council through the functions appertaining to the meeting.

The Programme of the Meeting of The Gas Institute.

THE programme of the Belfast meeting of the Incorporated Gas Institute has been issued by Mr. Walter T. Dunn, the Secretary; and we give full particulars of the technical business in another column. The chair will be taken by the President, Mr. James Stelfox, on Tuesday, the 21st prox., in the Exhibition Hall of the Botanic Gardens Park; and the Institute will be officially welcomed to Belfast by the Lord Mayor, Mr. Alderman James Henderson. The meeting will occupy the usual time; but there will be no afternoon sittings unless this is found to be absolutely necessary. There is a list of papers, the quality of which —judging from the titles and the names of the authors— appears unexceptionable. Indeed, it is doubtful if the Institute was ever better served in this respect. Mr. R. S. Carlow, of Arbroath, will bring before the meeting the subject of the Standardizing of Meter-Unions, in which the North British contingent of the gas industry have long taken marked interest. Mr. W. F. Cotton, of Dublin, will show the Necessity for Amendments in the Gas-Works Clauses Acts. It is needless to say how welcome the working chief of the Alliance and Dublin Consumers' Gas Company will be to the meeting. Mr. C. S. Ellery, of Bath, has the responsibility for introducing to the Institute the inevitable subject of the Workmen's Compensation Act, 1897; and it could not be in better hands. "The Construc-" tion of, and Mode of Working, Gas Purifiers," by Mr. Henry Green, of Preston, will be an interesting paper by a master of gas management. Mr. William Newbigging, of Manchester, is prepared to wrestle with the Assessment of Gas-Works; Mr. R. G. Shadbolt, of Grantham, promises a paper on " Village Lighting—A Comparison;" Mr. John T.

Sheard, of Sheffield, will offer some useful "Laboratory "Notes;" and Mr. S. Y. Shoubridge will describe the Inclined Retorts at Salford. The now happily-restored Institute Lecture will be delivered on the morning of Wednesday, June 22, by Professor Vivian B. Lewes; and the subject chosen will be "Acetylene and its Latest "Developments." From this list, it will be seen that the morning sittings can hardly fail to be both interesting and instructive. For the afternoons, a number of the industrial establishments and municipal departments for which Belfast is renowned will be thrown open for inspection. The excursion on the Friday is to Rostrevor and the Mourne Mountain district; than which it is unnecessary to say more, except that the time-table for the day has been remarkably well arranged. We have no doubt that a goodly number of members and friends of the Institute will assemble to do honour to the organization and its generally-respected President, who, we are certain, will do all that in him lies to assure the success of the gathering and conduce to the personal comfort of the visitors to Belfast for the occasion.

The New Instructions of the Metropolitan Gas Referees.

With the present issue of the "Journal" we are able to give our readers the full particulars of the long-expected revision of the Referees' Instructions for the testing of the London Gas Supply. It is impossible to summarize here the nature and extent of the various changes made in the new Instructions, which in point of fact alter nearly everything except the sulphur test, the test of pressure, and the physical constants to be used by observers in correcting their results for temperature and pressure. A sweeping reform is to be carried into effect in every testing-station in London, so soon as the necessary apparatus can be procured and installed. The Referees will inspect and certify the equipment of the testing-stations; and then the Gas Examiners will be able to go ahead upon the new lines. Enormous labour has gone to the preparation of the new scheme of testing; and it is only fair that the painstaking work of the Referees in this regard should be recognized. Especially is it due to the newest recruit of this illustrious body, Mr. C. Vernon Boys, to acknowledge the devoted way in which the novel burden of participation in the preparation of the new Instructions has been borne by him. The Metropolitan Gas Referees take a very serious view of their duty to the public and to the Gas Companies. They do not bulk largely in the public eye; nor does their work earn for them the outside reputation that far less arduous and anxious toil in other fields brings readily enough. Whatever they do must be rightly done, or their authority would be gone. They have been perilously near making a mistake or two of late years; but it is to be hoped they are now on the right track. The change cannot be made in a day; and it will be long afterwards before its full effect will be disclosed. It will be understood that we are not prepared to-day to offer any criticism of the new Instructions, which have only reached us on the eve of going to press. Our "Correspondence" columns are open, however; and when the new order has fairly come into force, if there is aught to be said concerning it, we shall be glad to hear the story.

The Agitation against The Gaslight and Coke Company.

On Wednesday evening last a meeting to protest against the increase in the price of gas in North London was held at the Holborn Town Hall. The inevitable Sir Albert Rollit was in the chair; but if the gathering was meant to be a sample of the "public opinion" of the Metropolitan populace respecting a matter of local polity, it can only be properly regarded as another proof that Londoners do not care for these things. Who is Sir Albert Rollit, and what is any meeting that could be held within the Holborn Town Hall, that they should be regarded as representing London? The traditional town's meeting as it is seen in London is a farce. It may be doubted whether it is possible to focus the public opinion of cities like Liverpool, Manchester, or Sheffield by the antiquated machinery of an open meeting; but it is absurd to pretend that this can be done in London. If the obvious alternative is attempted, and a series of district meetings is got up, the only noticeable effect produced is that of a "starring tour" of the same company of platform performers. It is not to be denied that the inhabitants of the Metropolitan district served by The Gaslight and Coke Company have a substantial grievance in the higher price that they have to pay for their gas as compared with their fellow-townspeople of the South and East. There is no getting over this fact by any process of reasoning, whatever may be the explanation that comes closest to the truth of the matter. Explanations, as the wise man has well observed, are only needed for failures; successes do not require to be explained. Hence it is that the South Metropolitan and Commercial Gas Companies are not troubled; while all the would-be leaders of London Municipalism are out on the war-path against the Horseferry Road Administration.

If Sir Albert Rollit is correctly reported in the "Daily "Chronicle" of last Thursday, however, he treated his hearers to most unlawyer-like talk at the Holborn meeting. He is asserted to have stated that the Chartered Company "had drawn some two millions of money beyond "their statutory dividends; and he was prepared to "declare that they gave a fraudulent preference to South "London in this matter." What the last sentence means we are unable to divine. As to the former declaration, however, it can only be pardoned upon the charitable assumption that even Sir Albert Rollit is not omniscient, and was on this occasion speaking beyond his book. This sort of thing darkens counsel. What the Directors of The Gaslight and Coke Company have done is not the paying of dividends in excess of their statutory powers—and even Sir Albert Rollit might have known that, if they had done this, the remedy would be short and easy. They have led the undertaking into difficulties, and imperilled the repute of the sliding-scale, through having persisted in paying dividends that, although perfectly legal, were not earned. They did this until all the reserve funds of the undertaking were spent, when they were compelled to put up the price of gas by 2d., and submit to see the dividend diminished accordingly. It is a question of opinion whether, if they had pursued the policy of not dividing up to the full statutory figure, their position would not have been better to-day; but it is nonsense to accuse them of acting illegally. Their error, if any, has not been one of law, but of policy. So long as the agitation against the Company is ill-directed, it cannot help the consumers or the proprietors, which we take it is the only proper object with which the administration can be attacked in or out of Parliament. The meeting passed a resolution to the effect that the difference of 9d. per 1000 cubic feet between the prices of gas North and South of the Thames "is absolutely unfair;" and here the matter ends.

A Vindication of Coke-Breeze Concrete.

It is an old saying that good oftentimes comes out of evil; and the proceedings that have followed upon the lamentable building accident in Westminster, when seven men lost their lives through the collapse of a "mansion" in course of construction, may well exemplify the truth of the adage. It will be remembered that the accident happened on the 21st of April; and last Thursday the architect, a Mr. Pawley, was committed by the Westminster Coroner to take his trial on the charge of manslaughter—the Jury having found him guilty of culpable negligence of his proper duty. The community are to be congratulated on the splendid service done in the cause of public security by the Coroner, Mr. Troutbeck, his Technical Assessor, Mr. John Slater, and the public-spirited and intelligent Jury. We must write with all reserve upon the personal consequences of the inquiry. The unhappy man Pawley must take his trial; and it will be a fair one. What we have to speak about here is not his share in the affair, but the catastrophe itself, the character of the building construction involved, and the general results of the Coroner's inquest. Too much praise cannot be given for the dogged perseverance with which the facts of the occurrence were dragged to light in this instance. Day after day the Court sat, patiently hunting responsibility to its resting-place, and finding out how and why all that happened came to pass. Several tissues of circumstance were passed through this ordeal. First was the Building Act. One result of the inquiry must be a thorough overhauling of the legislation now applying to the building of English towns. The accident is to be regarded, from one aspect, as an object-lesson of the manner in which the existing law fails to meet the requirements of public security. This defect can be remedied by amending-legislation, more directly bearing upon the revealed ways of the speculative builder, to whose enterprise the construction of our towns in their actual fashion is chiefly due. It is a hackneyed trick to abuse this personage, and one that we are not disposed to repeat. He is a tradesman neither more nor less honest and public

spirited than the rest of the people for whose housing accommodation he provides. House-building, however, is one of the last expressions of a complex civilization, as it was one of the earliest efforts of man delivering himself from barbarism. Hence the main difficulty of controlling it. There is no sense in exclaiming against the complexity of modern building laws, which cannot, by the nature of their subject, be anything else than very complicated. The chief thing to be regarded is that these laws shall be adequate to their purpose; the next, that they shall always be faithfully carried out.

One of the most important of the questions of construction arising out of the accident related to the use of coke-breeze concrete for the fireproof floors and roof. On the face of it, the accident consisted of the collapse of a sheet of coke-breeze concrete forming the roof, which in falling carried everything before it. If this had been all, the use of building material of this character for such a purpose would have been more than a little discredited—not logically, of course, but as a question of opinion and feeling. Now, there is more than mere trade interest involved in the maintenance of the fair repute of coke-breeze concrete. It is a material which, as many leading London architects testify, offers better promise than anything else of satisfactorily superseding the dangerous and insanitary deal floors, staircases, and skirtings that figure largely in the construction of the modern English house. With every successful example of its use, workmen get more used to handling it; and it consequently becomes cheaper and more serviceable. Coke-breeze concrete, like all other descriptions of the material, has had to make its way against all the forces of use and wont; and especially has it incurred the enmity of the carpenter and the slater. If a little fresh prejudice could have been piled up against it as a reflection of the Westminster disaster, the fashion of it would have received a check from which it might have taken long to recover. But though the concrete roof slab of the Westminster "mansion" broke and fell, the Coroner's Jury have found that this was merely an effect, not a cause. Interested evidence was given to show that the concrete was at fault; but there was something else to be considered. How was the concrete slab supported? It rested mainly upon a pier of brickwork in cement, the sufficiency of which therefore came in question. The pier was built well enough; but what of the design? Here the Jury found the true cause of the mischief. The pier was carried up until there was a calculated load of 7 tons per superficial foot of the base. We shall not pronounce any opinion on this head. Suffice it to lay stress upon the way in which a useful material of building construction—that is coke-breeze concrete—came through the ordeal of one of the strictest inquiries on record.

The Approaching End of the Welsh Colliers' Strike.

It has been useless for some weeks past to discuss the South Wales colliers' strike, because there was no appearance of a break in the clouds that had settled down upon the suffering industry. The single comforting feature of the situation was the ease with which all the legitimate demand for fuel was being met throughout the country; which was an additional proof of the suicidal character of the colliers' revolt. At first, as was only natural, coal prices jumped up in different places; but this effect was transient. No sooner had the Miners' Unions begun to think they were in for an advance, than the temporary fillip to prices passed. The coalowners in many instances refused to be tempted by the bait of higher prices, which they did not believe could be sustained; and they contented themselves with selling all the coal they could dispose of at the old rates. Better business, instead of a snap profit, was their principle; and, of course, it soon had its effect upon the market. It is a fact that coal, including gas coal, is a little dearer this year than it was last; but this has nothing to do with the Welsh colliers' strike. With regard to the latter subject, it was reported at the close of the past week that the majority of the men had come to see their folly in admitting to their meetings the representatives of certain newspapers, who reported all their nonsensical talk, helped to create bad blood between the parties, and treated the whole thing as material for "copy." Also, they decided they would entrust their representatives with plenary powers. This was the employers' *sine quâ non*. No time was lost by the men's Provisional Committee, thus authorized to treat with the employers, in seeking a meeting with the latter; and a conference has been arranged for to-day, at Cardiff. There is some hope, therefore, that order may soon be restored to this sorely-tried industry.

WATER AND SANITARY AFFAIRS.

Sir Alexander Binnie has done his best to persuade the members of the Royal Commission on the Water Supply of the Metropolis that it would be cheaper to fetch 114½ million gallons from Wales than to obtain this quantity from the Thames through the Staines Reservoirs Scheme. Acknowledging that 185½ million gallons may be properly taken from the Thames, Sir A. Binnie contends that, in proceeding to make up the 300 million gallons required in 1931, it will be financially advantageous to obtain the balance from the Yrfon. In seeking to establish this proposition, the Chief Engineer of the London County Council seems to have set himself a hard task. He has, indeed, as one of our contemporaries says, put in "a mass of "figures," though there is one item wanting, and that is the average depth of the proposed Yrfon reservoir. He declines to be explicit on this point; pleading that to give the information might prejudice the County Council in bargaining with the landowners. That there will be some little difficulty in that quarter we may imagine, when we find, as intimated by Mr. Pember, that a great number of farms will have to be submerged—"naturally," as Sir A. Binnie admits—and also upwards of a hundred houses. Mr. Pember has urged that the depth of water should be given, as it was most important to know what quantity could be stored. This is true enough, only we question whether the settlement of terms with the landowners need trouble anybody, at least for a generation to come. The Welsh scheme is a long way off, though great anxiety is displayed by the County Council to make some appearance before Parliament next session. In consequence of this, they have just resolved to suspend certain Standing Orders so as to extend the time for preparing a Water Bill of some kind—probably another scheme of purchase, if not a plan for a "supplementary supply." The view which the Royal Commissioners take of the subject is that if Mr. Pember can establish the superiority of the Staines scheme on financial grounds, as compared with the Welsh project, that will be a matter for careful consideration. We do not think Mr. Pember will find his task a very arduous one. It would seem to be decidedly more facile than the demonstration which Sir A. Binnie has undertaken. The Welsh aqueduct alone would cost the best part of seven millions; whereas the Staines reservoirs will have the benefit of a natural aqueduct as furnished by the River Thames, having its head waters in the West of England. Much is said about the increasing population of the Thames Valley, and the risk of an augmented pollution of the stream. But we apprehend that the danger, such as it may be, is decreasing rather than otherwise. The drainage of towns is far more carefully carried out now than it was formerly; and there is continual improvement in the treatment of sewage. We may venture to say, despite some defects which are already receiving consideration with a view to their amendment, that the Thames was never so successfully protected from pollution as at the present time; and there is no reason to apprehend any retrogression.

Regardless of the dignified rebuke administered by Mr. Boulnois at the recent meeting of the West Middlesex Company, the Progressives of the County Council continue to accuse the Royal Commission of dealing unfairly with the Council's witnesses. This time it is not Mr. Dickinson, but Mr. Shaw Lefevre, who makes the attack. His complaint is that the Chairman of the Commission cross-examines these witnesses, and denies them the privilege of an examination-in-chief. In this process of cross-examination, the Chairman is said to vie with the Counsel for the Companies; and the "Daily Chronicle" describes Mr. Shaw Lefevre as calling attention to "the grossly un-"fair way" in which Lord Llandaff and his Commission have acted in this respect. Looking at the solid evidence given by Sir A. Binnie and the gentleman from Paris, as well as by Mr. G. F. Deacon, and also at the fact that Mr. Dickinson came before the Commission three times, while Sir Arthur Arnold appeared more than once, we cannot see any proper foundation for the complaint that the evidence of the Council's witnesses has not been adequately brought

out before the Royal Commission. We might name other witnesses on the side of the Council whose evidence has been taken at great length. In fact, the Council have had a long pull and a strong pull before the Commissioners; and if the Council's case has not been rendered clear and convincing, the fault must be inherent in the case itself. The Council never have been pleased with their luck on the Water Question. Parliament has not helped them, the Government have blocked their way, and now the Royal Commission seems likely to bring out an adverse report. The Council threaten to go to Parliament again. Yet it cannot be said that their prospects in this quarter are at all improved; and until the report of the Commission appears, it will be indecorous to approach the Legislature on the question which has been submitted for inquiry.

The British Association of Water-Works Engineers had a very courteous reception at Southampton last week. The President for the year is Mr. William Matthews, the Corporation Water-Works Engineer, whose work in the latter capacity has been of no mean order. It was not surprising, therefore, to find that the Mayor (Alderman G. J. Tilling), the Chairman of the Water Committee (Alderman Lemon), and other members of the civic body, had entered most enthusiastically and generously into the arrangements for making the visit one which will long be remembered by all those who had the good fortune to be present. Last year we called attention to the poorness of the attendance at the annual meeting held in London, and concluded that this indicated in some measure a want of interest in the work of the Association. The regret then expressed is equalled on this occasion by the gratification of being able to record that, although Southampton involved a long and tedious railway journey for many of the members, they assembled in good numbers from all parts of the country. The attractive programme may not alone be the explanation of this. As time has gone on, the members, who before they became associated were, comparatively speaking, strangers to each other, have become better acquainted; new friendships have been struck; and the frigidity of the first meeting or two has now been dispelled by a geniality which makes the gatherings pleasant and inviting. Then, again, the time selected for the meeting this year was, no doubt, a more suitable one for the absence of a water engineer from home than July, in which month his energies are frequently severely taxed in keeping pace with the demand for water. We are not cognizant of the views of the Council on the point, but in our judgment—and the attendance last week supports it—it would be of general convenience if May were selected for the annual meetings. The membership continues to increase; and it is interesting to notice that fresh applications for admission have been received from distant parts of the globe.

The report given elsewhere to-day, and the papers and discussions which will be published in early issues of the "JOURNAL," require little in the way of comment. There is, however, one point in the President's address which must not be passed over without remark. Referring to the dual management of gas and water works, he said: "It is a notorious fact that, with few exceptions, "such undertakings are, as regards the water supply, "scandalously badly managed or, perhaps, more properly "speaking, neglected." We freely admit having a preference for the distinct and individual supervision of such undertakings, but protest against the almost general condemnation of present dual management which his words convey. The President's strictures might very possibly be supported by one or two examples of indifferent management of combined gas and water undertakings; but, on the other hand, there are a greater number (in the management of some of which members of the Association have been and are concerned) which could not be brought within the pale of his impeachment. However, the address is one which is full of subject for thought, and worthy of careful perusal. Regarding the papers read, that which Dr. Percy F. Frankland contributed on the subject for which he has gained world-wide fame as an authority, had quite a fascination for the members; and the others were all practical and useful additions to the proceedings. The Senior Vice-President for the year is Mr. William Watts, the Engineer of the new water-works of the Sheffield Corporation in the Little Don Valley. We venture to hope that his election to the position he occupies in the Association gives promise of an interesting visit for the members next year.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1270.)

BUSINESS in the Stock Markets last week was quiet enough in all conscience. This was only to be expected in Epsom week, which also had Whitsuntide at the tail of it, and was moreover account-week in itself. But quiet as things were, there was an excellent under-current of feeling; and when on Thursday the cheapening of money was put beyond a doubt, there was almost a little boom. It came as a great relief after the tension recently produced by political anxieties; and, if all is well that ends well, then last week was a happy one. Thus prices have benefited all round; and, conspicuously among them, Consols touched a figure which they have not seen for weeks. The 4 per cent. Bank-rate, which had lasted seven weeks, came to an end on Thursday, when the Directors reduced it to 3½; and if we have no more scares, it may possibly soon go still lower. Business in the Gas Market, in this interrupted and abbreviated week, was of a very limited description. Variations in quotations have been irregular—on the balance there were about as many ups as downs; but perhaps the ups and the "steady unchanged" have the best of it in point of importance. Gaslight "A" was very lightly dealt in, and was practically unchanged, though the best price of the week was a fraction better than that of the week before. The few transactions marked in the secured issues were devoid of feature. South Metropolitan was fairly active, and like Gaslight "A" touched a better figure. The debenture, however, had a fall; and on Tuesday it changed hands at par. Commercial was a little inclined to droop; and the old stock receded a point. The Suburban and Provincial undertakings were quite inconspicuous, save for a fall in Crystal Palace. Among the Continental Companies, the feature was a recovery in Imperial of the points it had lost the week before. Union and European were both unchanged. Among the minor Gas undertakings, Australian and Chicago advanced; but Cape Town was weaker. There was moderate business done in the Water Companies, but without any show of strength, and one or two quotations receded.

The daily operations were: Business opened only sluggish on Monday; but prices were very fair. Imperial Continental and People's Chicago rose 2 each. Crystal Palace Gas fell 3. On Tuesday, everything was very quiet except South Metropolitan. The ordinary was firm; but the debenture fell 2. Wednesday brought no improvement in activity; but prices ruled good. Australian and Imperial Continental rose 1 each. In Water, Chelsea debenture fell 1. Thursday's business was much limited, and prices were easier. Commercial old fell 1; and Cape Town, ½. In Water, New River fell 5. Friday was extremely quiet; but prices were good—South Metropolitan marking 138. Cape Town fell ½. In Water, West Middlesex 3 per cent. debenture fell 1.

ELECTRIC LIGHTING MEMORANDA.

The Substance of the Report of the Joint Committee on the New Electricity Supply Schemes—Liability for Nuisance—Compulsory Powers for Outlying Stations—The Limits of Municipalism Surpassed.

THOUGH the report of the Joint Committee on the new electricity supply schemes, presented to Parliament last week, has not yet been issued, a statement purporting to give the substance of the most important recommendations has appeared in some newspapers. According to this information, which at least bears the impress of probability, the Committee are agreed on the point that the proved public advantages of electric light and power supplies warrant the encouragement of large undertakings of the kind such as are contemplated in the Bills now before Parliament. This decision, it will be seen, amounts to a declaration that the preamble of the general proposition has been proved. The Committee are prepared to recommend that facilities should be granted to undertakers of electrical supplies for the compulsory acquisition of sites for generating stations, and also of way-leaves for their mains. It is considered that the procedure for obtaining these facilities should be by Provisional Order, through the Board of Trade, whereby a regular system may be developed, subject to the control of Parliament. The Committee think that procedure by Private Bill should be reserved for the present for very exceptional cases. This is an eminently common-sense way of treating the question. It contemplates an extension of the Provisional Order system; but this was to have been expected, since Sir Courtney Boyle, for the Board of Trade, practically invited the Joint Committee to entrust the Department with the power to sanction the compulsory purchase of land which the existing law does not confer. While the Provisional Order system was on probation, it was as well to preserve the sharp distinction between an Order and a Bill, which was universally recognized. But as the work of the Board of Trade under the system grew into a more and more complete realization of the idea of devolution of powers by

Parliament, it became increasingly evident that the restriction upon dealing compulsorily with land would have to be removed. The reservation of the duty of Parliament to confirm all Orders should answer all objectors to the extension proposed.

Upon the important question of undertakers' liability for nuisance, the Committee are stated to be of opinion that where a site for a generating station is acquired under compulsory powers, as specified, the undertakers should not be subjected to further liability in this regard than that which is imposed by the common law in the case of persons exercising statutory powers and duties. The report refers here, as a definition of the law, to Lord Blackburn's judgment in *Geddis v. Bann Reservoirs Company* (3 App. Cases, 430). This leading case is mentioned in the fourth edition of "Michael and Will," p. 192. It is here described as establishing the principle that "if, by a reasonable exercise of the powers either given by statute to the promoters, or which they have at common law, the damage could be prevented, it is, within this rule, 'negligence' not to make such reasonable use of their powers." The whole passage is worth studying. On the other hand, the Committee hold that where the site for a generating station is acquired by agreement only, the undertakers ought to be subject to the full liability imposed by the common law. If this recommendation is acted upon by Parliament, there will be quite a rush of electrical undertakers to get statutory protection for their works. Here, however, the obligation of giving notice to neighbouring owners and occupiers will come into force.

Upon the novel question as to whether compulsory powers should be given for the acquisition by electrical undertakers of land not within the area of supply, the Committee answer in the affirmative. They do not see why these outside generating stations should not be sanctioned, subject to certain stipulations which they are prepared to formulate. This entails the grant of way-leave for trunk mains, which is accordingly passed; but it is thought that the local authorities liable to maintain the thoroughfares used for these mains should have the same option of themselves breaking up and reinstating the streets at the undertakers' expense as is now given in Provisional Orders to authorities within the limits of supply. The report proceeds to state that where it is proposed to convey current for traction purposes by the overhead wires, it is not advisable that every local authority whose district is traversed should have an absolute power of veto over the project. Such power might be placed with the London County Council and the county boroughs; but other local authorities, it is thought, need only have *locus standi* in regard to such schemes.

The Committee have the courage to state that, where sufficient public advantage is shown, powers may well be given for the supply of electrical energy over an area including districts of numerous local authorities, and involving plant of exceptional dimensions and high voltage. This recommendation will be the charter of the new order of electrical undertakers who desire to rise superior to the accidental limitations imposed by the territorial boundaries of municipal powers and privileges. As to the interference of such extended powers with the policy of encouraging local authorities to acquire district electrical undertakings after a term of years, the Committee accept the fact, and argue that the power of purchase conferred by the Electric Lighting Acts is inapplicable, as a general rule, to the case of an undertaker supplying energy in bulk at high voltage. No such project was in contemplation when these Acts were passed; and besides, at that time the main application of electrical power was to the purpose of lighting. The evidence laid before the Committee showed that, though electric light is at present the predominant feature of the electrical enterprises now before the public and Parliament, the application of electrical energy in the form of power to an infinite variety of other purposes is likely to be in the near future the predominant feature and function of these undertakings. Moreover, the Committee fail to see that it is desirable for a local authority to have anything to do with an electrical undertaking supplying energy in bulk at high voltage and in comparatively few mains. All the same, the Committee do not propose that the power of purchase in respect of these new undertakings should be absolutely withheld from local authorities; but only that they should not have it as a matter of course. It would always be open to a local authority, alone or in combination with others, to show cause for procuring the transfer of an undertaking. Where exemption from liability to be purchased by the local authority is granted to electrical undertakers, the Committee think it would be specially expedient to enact in their regard some sliding-scale such as that applied to gas undertakings. It would be difficult to exaggerate the importance of the principal conclusions of this report, to which we shall have to refer again.

Molecular Weights of Gases.—At a recent meeting of the Academy of Sciences, M. Daniel Berthelot dealt with the subject of the molecular weights of the easily liquefiable gases. Starting with the theorem that the molecular weights of gases are proportional to their limiting densities when the pressure is infinitely small, from the experiments of M. Leduc, the true density ratios of oxygen, carbon dioxide, nitrous oxide, hydrochloric acid, acetylene, phosphoretted hydrogen, and sulphur dioxide are determined; the precision being, in the opinion of the author, equal to that obtained by the best chemical methods.

BOULNOIS ON MUNICIPAL ENGINEERING.*

ORDINARILY, it is unnecessary to review the third edition of a book at length, for obvious reasons. In the case of technical handbooks, however, which are, or should be, practically rewritten for every successive edition, this careful examination of the work at every reappearance is a duty due to the author and his public. Especially is this an obligation in respect of the literature of practical engineering, which is always going out of date and needing revision from the moment of issuing from the press. Mr. Boulnois' book reminds one of the progress of specialism in engineering, which has been going on at an accelerated rate during the past quarter of a century, and bids fair to continue until the generic description "engineer" will cease to possess any distinctive meaning at all. Of all the results of the process of differentiation as carried on in the world of engineering, the municipal and sanitary engineer is one of the most useful to his kind. Indeed, one might almost say that in producing this variety of the genus "engineer," the course of differentiation has returned upon itself; so that the specialist in town and sanitary engineering is in reality as much of an all-round man as was the primitive engineer. What are his specialities? A glance over Mr. Boulnois' index shows what a bewildering number and variety of responsibilities have accumulated upon the official whose legal description is Town Surveyor. The undertaking of these responsibilities converts the Town Surveyor into the City Engineer. The process of development is exhibited in the author's own official experience, as stated on his title-page: "City Surveyor, Exeter, 1873-1883; Borough Engineer, Portsmouth, 1883-1890; City Engineer, Liverpool, 1890-1898." Here we have the whole story in the most concise form.

Once more, such a book as this serves to mark the radical difference that exists between English and Continental conceptions of the nature of engineering. The product of Continental engineering colleges is first and foremost a mathematician. He would think it beneath him to write a professional paper that did not bristle with algebraic formulæ; and he plunges gaily into the calculus over some question of the grading of a public road, or other equally simple matter. If he is only sufficiently learned, and reasonably lucky, the Continental engineer gets a nomination as third or fourth City Engineer to some small market town which is probably undrained, and has no intention of spending money upon such frivolities as sewers. Here he will have plenty of leisure to go on with his calculations, in an apartment of a Town Hall the whole atmosphere of which reeks of the untended cesspools on the ground floor. There are no calculations in Mr. Boulnois' book. His model City Engineer is a man who knows how to do a multiplicity of things, and is more than half a lawyer into the bargain. There is a good deal of law about municipal engineering, which exists by the provisions of the Public Health legislation of this country—a legislation which has no parallel in any other land. Besides his legal office of Town Surveyor, the modern City Engineer is expected to be able to advise his employers with regard to matters which it takes pages of Mr. Boulnois' book merely to name. It is manifest from this recapitulation, which is based upon the actual practice of English boroughs, that mere knowledge will not go far to equip a City Engineer. He must be a man of affairs as well, with a degree of force and quality of personal character that cannot be acquired. Happily, the type of man needed is fairly plentiful in England.

We have not much to do with many of the duties and responsibilities of the City Engineer; but he is an official with whom the Gas Manager of the district has necessarily many and intimate dealings. It is therefore expedient that Gas Managers should have at hand a guide to the work which devolves upon the Town Surveyor, in order that they may be able to look from his standpoint at questions of road repairing, public lighting, and so forth, in which they may be mutually interested. We can heartily recommend Mr. Boulnois' book for this purpose. It is a work that satisfied a distinct want, and is characterized by close grip of the subjects treated. The reader feels that he is being talked to by a man who is giving the results of his own experience and observation; and there is absolutely no "padding."

Take, for example, the subject of street paving. Here we find Mr. Boulnois recommending tar macadam, prepared and laid according to directions which he gives in detail. On the other hand, he notes that in San Francisco an experiment in paving has been tried with bricks boiled in coal tar, "which, it is *said*, renders them tough and hard." The bricks are set in boiled tar, and screened gravel is put over the surface. He will not vouch for the results. To his credit be it said, Mr. Boulnois' favours hand-broken road metal over the machine-made article; and he ascribes the decadence of modern roads to the excessive use of binding materials. Macadam did not use "binding;" but then he did not use the roller either. Road-rolling is now the settled practice; and the road-roller requires some binding material. Mr. Boulnois utters a warning against making a road too quickly under a heavy roller, only to go to

* "The Municipal and Sanitary Engineers' Handbook." By H. Percy Boulnois. Third Edition, Revised and Enlarged. London: E. and F. N. Spon; 1898.

pieces again under the ordinary traffic. He gives a good prescription for making tar pavement for footpaths; but he will not rank this kind of pavement higher than a "substitute for ordinary gravelled footpaths."

The subject of street lighting is common ground for the gas and the city engineer—likewise for the electrician, who has come upon the scene since the first edition of this book was written. Mr. Boulnois also acknowledges that incandescent gas lighting has put in an appearance during the same period, greatly to the advantage of the wayfarer. Mr. Boulnois has a very open mind in regard to street lighting. Not for him the elaborate calculations of lighting effect on the surface of the street, such as M. Maréchal affects in his book on the lighting of Paris. Mr. Boulnois merely states that an electric arc lamp usually takes 500 watts (half a unit) per lamp-hour, "which gives a photometrical light of about 600 candles." He credits the "Janders" [? Jandus] lamp with keeping its carbons efficient for 120 hours. As regards the position of street-lamps, Mr. Boulnois justly remarks that this must be guided by local circumstances; "but, as a rule, the central position gives the maximum of effective light, and only in very exceptional cases should the lamps be more than 100 yards apart." He likes "the Continental system of centrally suspending lamps on wires stretching from houses on each side of the street." His Liverpool experiences with incandescent gas-burners for street lighting seem to have been unusually vexatious at the start, until Mr. C. R. Bellamy came to the rescue with a lantern which proved to be a "most marked success." The fact that the author will only speak of what has passed within his own knowledge, however, is commendable.

On the subject of street lighting in general Mr. Boulnois is very sound. He recites the powers of local authorities in this regard, and describes various systems of lighting. He strongly advises the adoption of the plain, straightforward method of lighting all the public lamps "within one hour of sunset from the beginning of January to the end of April; and then, taking advantage of the twilight, the time is gradually extended to one hour and three-quarters at Midsummer, from which point it gradually decreases in the same ratio to the end of September, where it is brought back to one hour after sunset, which position it maintains to the end of December." He gives a diagram to explain the system, which he thinks is "the most satisfactory to the inhabitants, the local authority, their officers, and the gas company. It is the least likely to introduce disputes; and although something may be saved by adopting the more parsimonius methods enumerated, it is found in practice that the first is the best." Mr. Boulnois relates how in Liverpool, in 1894, it was decided to try the experiment of reducing the illuminating power of the street-lamps to half of their full power at midnight. The total annual cost of the service under the old system was £33,156; and it was estimated that the new one would only cost £26,169—thus showing a saving of £7007. As a result, it has been found in practice that the estimated saving "was considerably below the actual figure." Mr. Boulnois is most emphatic in his testimony as to the efficiency of the Liverpool street-lighting service.

Suggestions are offered for the heads of an agreement between the Local Authority and the Gas Company for street lighting. Mr. Boulnois thinks street-lamp meters are unnecessary where governors are used. All his remarks upon the choice of lanterns and lamp-posts are sensible; but perhaps this part of the duty of a City Engineer might have been worked out in greater detail. The chapter on "The Breaking-up of Streets" reads as if it had been written in the (official) blood of the City Engineer of Liverpool. It is very good. The author points out how the law of the subject, as applied to Statutory Gas Companies, does not perfectly match the practice. He proposes to get over the difficulty by drafting a "plan," or specification, under which Gas Companies should be compelled to work after giving the usual statutory notice of their intention to break up a street. It is impossible to withhold sympathy from the man who writes as follows: "It is unfortunately the practice generally for the men in the employ of a gas or water company, after laying a pipe, to try and ram into the trench all the material they have removed, without allowing for the cubical contents taken up by the pipe, or if they do condescend to cart anything away, it is generally the metal, which they think will come in nicely for the repairs of the trench during their liability for such repairs." Only too often, when a trench has been made in a macadamized road, the trace remains, either as a hump or a pit, for long afterwards. Local Authorities have the remedy for this very much in their own hands. The smartness or otherwise of the highway service in all respects is likely to have a great effect upon the men of the Gas and Water Companies.

Altogether, this "Handbook" of Mr. Boulnois is a work to be highly commended. It is calculated to do a great deal of good; and the sincerity with which it is written is deserving of the most unstinted praise. There is not a scrap of pedantry in Mr. Boulnois; and he is not afraid of referring a reader to a practical authority, even though the practical man happens to be a manufacturer of specialities.

The New Water Supply of Paris.—For bringing to Paris the waters of the Loing and Lunain, under the new scheme, syphons will be employed, formed of cast-iron pipes, having inside diameters of 4 ft. 11 in. and 4 ft. 1 in., representing a weight of 14,700 tons of cast-iron and 1600 tons of steel.

PERSONAL.

Mr. WALTER HORSWELL has been appointed Secretary of the Ossett Gas Company, in succession to the late Mr. Castle.

With reference to the paragraph in this column last week, referring to the position of Mr. THOMAS GOULDEN as Engineer of the Beckton Gas-Works, we have authority for stating that the conditions of his appointment do not differ from those under which Mr. Methven held the post.

The Albert Medal of the Society of Arts for the present year has been awarded, with the approval of H.R.H. the Prince of Wales, the President of the Society, to Professor ROBERT WILHELM BUNSEN, M.D., For.Memb.R.S., "in recognition of his numerous and most valuable applications of chemistry and physics to the arts and to manufactures."

Mr. CHARLES WATSON, F.C.S., formerly of Wallsden, near Todmorden, and recently of Manchester, left England last Friday for Buenos Ayres, to take the position of Head Chemist and Manager of the Chemical Department of the Primitiva Gas Company. The Company engage extensively in the manufacture of disinfectants and anhydrous ammonia—the latter being largely used locally for refrigeration.

OBITUARY.

The death is announced of Mr. W. GREEN, the Chairman of the Ryde Gas Company. Deceased was an octogenarian, and one of the oldest tradesmen of the town.

We regret to record the death last Thursday morning, of Mr. ROBERT WALLIS, J.P., the Chairman of the South Shields Gas Company. Deceased was a native of South Shields; his father being a well-known shipbuilder. For some years he carried on a very successful medical practice, and was much respected by all classes; his kind, generous nature winning for him especially the love and regard of the poor, to whom he always extended a ready sympathy. He retired about fifty years ago, and went to live at Old Ridley, where he resided until his death. He was a County Magistrate, and was for a long time Chairman of the Bench at Hexham; but he retired from the position a year or two ago. He filled the position of Chief Magistrate for two years (1860-1). Mr. Wallis was, however, best known to South Shields people of the later generation by his connection with the Gas Company, of which he was a Director for about half-a-century, and Chairman for the last forty years. At the annual meetings of the Company his well-reasoned speeches were always listened to and read with very considerable interest. He had been only once absent during his long period of chairmanship, and this was last year, when his health began to fail, and his place was temporarily supplied by Dr. Armstrong. He, however, presided at the meeting last February. Mr. Wallis was no "ornamental" Chairman. He took a lively interest in gas manufacture, and especially in the work of the North of England Association of Gas Managers, of which he was an associate member—his tall, upright figure being familiar at the half-yearly meetings of that body. Recognizing his fitness for the presidency, his colleagues selected him to fill this office for the year 1891-2. In the short, but interesting address, delivered by him at the October meeting in the former year, he disclaimed the possession of advanced scientific knowledge, and said his only qualification for the position to which he had been elected was the circumstance that he was not only one of the oldest in years, but one of the oldest in official connection with the gas interest throughout the area embraced by the Association. He nevertheless showed his keen appreciation of the requirements of the gas industry, by commending to the attention of the members the subjects of mechanical stoking, the amalgamation of companies, alike for the manufacture of gas and the treatment of residuals, and the best methods of popularizing and promoting an increased consumption of gas for other than lighting purposes. In proposing a vote of thanks to Mr. Wallis for his address, Mr. Hepworth remarked that though the President had spoken regretfully of his want of knowledge of scientific methods, the members all knew that he was one of the first to introduce them for the manufacture of gas, and that the South Shields Gas Company were largely indebted to the ability he had exercised as their Chairman. Mr. Wallis was in his 90th year.

Society of Engineers.—At the meeting of the Society next Monday, Mr. E. A. Harman, the Engineer of the Huddersfield Corporation Gas-Works, will read a paper on "Gas-Works Machinery." According to the synopsis which has been issued, the author promises to take a survey of the whole subject. He proposes to deal first with the conditions of working and development of gas-works machinery; and the apparatus and points which he will then particularly refer to will be exhausting plant, gas-engines, pumps, lubricants, coal-stacking machinery, coke conveyors and breakers, furnaces, lifting and travelling apparatus for purifier covers, waste material and gases, retort-house operations, coal breakers, trucks, elevators, and conveyors, stoking machinery, and locomotives. The subject of depreciation will also receive attention. Arrangements have been made for a visit of members to The Gaslight and Coke Company's works at Chelsea on the 14th inst.

NOTES.

Chemical Tests for Carbonic Oxide.

M. Armand Gautier, in a communication to the "Comptes Rendus," states that when carbonic oxide is present in an atmosphere to the extent of some hundredths, as in the case of certain chimney gases, it is easily estimated by absorption by means of acid cuprous chloride. But when the gas is present in air only in thousandths or ten-thousandths, this method, even with M. Saint-Martin's excellent modifications—is of no value. Discussing the use of other reagents capable of being used for the detection of carbonic oxide, M. Gautier asserts that ammoniacal nitrate of silver cannot be depended upon if other reducing agents are present. Permanganate of potash at one-thousandth is reduced very slowly in the cold by carbonic oxide, but at one-hundredth its action is more rapid. Iodic acid at one-hundredth will not oxidize carbonic oxide in the cold; but at one-tenth, and at 100° C., the action is very marked. Chloride of gold at one-hundredth is an excellent reagent; with the pure gas its action is almost immediate. From all of this it appears that the process of chemical testing for carbonic oxide in air, when minute proportions of the gas are suspected to be present, is still a doubtful proceeding.

The Thermophone in Use.

It is reported in the "Chemical News" that the very handy thermophones of Professor Wiborgh, of Stockholm, are now in constant use at the Baltic works of the Russian Admiralty for a variety of purposes—for measuring the heat in chimney flues, under the boilers, and for indicating the temperature of fused metals. These thermophones consist of cylinders of fire-resisting material containing within them a fulminating compound. When thrown into a hot place, the cylinders explode in greater or less time according to the temperature. This time is noted, and referred to a table attached to every box of 50 thermophones. Mr. Sergius Kern reports that this simple method affords measurements of temperature quite correct enough for ordinary purposes. The above-named works have made use of the thermophones in the steel foundry for more than a year, chiefly for the purpose of ascertaining the temperature of the cast-iron run out of the cupola for the converter. The temperature of the metal in the converter is also taken; and the knowledge is found helpful in showing what can best be done with the material. The average temperature of cast iron before pouring into the converter is 1400° to 1500° C., falling in cold runs to 1000° C. These temperatures the thermophone measures easily enough; but when the temperature of the metal in the converter rises to 2400° C., they become unreliable.

The Needs of Road Motor Carriages.

Discussing the actual position of mechanical road traction in this country, the "Engineer" recently explained the reasons why such slow progress is made with the putting of motor vans upon the roads. The great mistake, says our contemporary, made by builders of motor cars has lain in under-estimating the power needed to propel them. The old notion that because a horse can do such and such things, 1-horse power in the shape of an engine ought to be able to do the same, has been slowly dissipated; "but it still remains almost impossible to persuade the inventor that, whereas a pair of horses can haul two tons at an average speed of six miles an hour on good roads, not less than a 20-horse power engine can do the same work. On a tramway, gas-engines have been substituted for horses, and even on level ground it has been found necessary to put in a 14-horse gas-engine to do the work of a pair of horses." This is undoubtedly the trouble over which many amateurs of mechanical road traction have come to grief. The conclusion arrived at is that if gas and steam power have such difficulty in the comparatively easy work of tramway traction, the heavier task of traction on common roads cannot be performed mechanically much better than it has been for years past by the best type of traction engines. The high-speed, light-load road engine can only be worked at a profit at prices which will be found prohibitive; the reason being the very high power which must be provided if traffic is to be conducted with certainty and punctuality. To provide this high power, and yet keep down weight, is an extremely difficult problem. Yet it is the problem that the steam or gas driven road car for every-day use must solve if it is to compete at a profit with the horse and cart.

Fuel in American Iron-Works.

In some "Notes on American Iron and Steel Practice," read as a paper before the South Staffordshire Institute of Iron and Steel Works Managers, Mr. Archibald P. Head described the gas-producers which are coming into increasing use in America. He mentioned as a very efficient form a producer square in section, with the corners filleted. The air and steam are blown in underneath the firebars, which slope steeply on both sides of a central line, like a house roof. A producer of this pattern, 7 feet square and 9 feet high, gasifies 6 cwt. of coal per hour. One man can stoke two producers; and one cleaner is required for every eight. The production of gas is about 130,000 cubic feet per ton of coal, and the gas contains about 4 per cent. of carbonic acid. With coal at 6s. 3d. per ton, and labour at 1s. 4d. per ton of coal, the gas costs 0·7d. per 1000 cubic feet. This gas, being one-fifth the calorific value of coal gas, is equivalent in price to the latter at 3½d. per 1000 cubic feet. Both natural gas and oil are used as substitutes for this producer gas in steel-melting furnaces, and for heating furnaces and boilers. In the Pittsburg region, natural gas is piped from a distance of 100 miles. It costs 5d. per 1000 cubic feet of gas delivered, and does not require any regenerating. It contains 92·6 per cent. by volume of marsh gas, and is about 7½ times the calorific value of producer gas. At present prices, there is no advantage in using one or the other; but natural gas tends to become dearer. Where crude oil is used for fuel instead of producer gas, it is blown in and at the same time vaporized by a steam-jet. The air only is regenerated. This oil has about 25 per cent. more calorific value than Welsh coal. "Whether or not it pays to burn it depends on the local conditions and the price of the oil; which latter, like innumerable other articles of common use, is not regulated in America entirely by the balance of supply and demand, but rather on the measure of success which attends the efforts of the combination which is so fortunate as to control it."

The Liquefaction of Hydrogen and Helium.

The first liquefaction of hydrogen on a practical scale was accomplished recently at the Royal Institution, by Professor Dewar; a wineglassful of the liquid being forthwith exhibited to Lord Rayleigh. It is understood that liquid hydrogen has been seen before, as our columns bear witness. That is to say, experimenters have seen, or supposed they saw, a momentary fog of liquid hydrogen particles inside a small glass tube; and they have eked out this much-desired observation of the fact with a mass of calculation designed to prove the result. Professor Dewar has actually procured the liquefied gas to the amount of half a wineglassful in five minutes, by a process which would equally have produced a pailful had the requisite supply of pure hydrogen been forthcoming. This is an unprecedented phenomenon. Liquid hydrogen in quantity is not only of great scientific interest in itself, but it is also of immense importance as placing a new and potent instrument of research into the hands of investigators in that region of intense cold where nothing retains its ordinary physical characters. The boiling-point of liquid hydrogen is placed at from 30° to 35° of absolute temperature, which is the nearest point to the absolute zero yet attained. Some conception of the intensity of the cold attained may be gathered from the fact that a tube closed at the lower end, when immersed in the liquid, was almost instantaneously filled with frozen air. The observed density of the liquid hydrogen far exceeds the calculated figure—about 0·6; water being unity. By the use of this fluid, the rare gas helium, which is kept in considerable quantity at the Royal Institution, has already been liquefied. Its boiling-point appears to lie not very far from that of hydrogen itself. Liquid hydrogen will never be so cheap as liquid air, because of the prime cost of the pure raw material. But nothing except the cost now stands in the way of the production of liquid hydrogen in any quantity required by science, whether for the investigation of its own properties, or for the prosecution of various lines of research into the constitution of matter in general.

COMMUNICATED ARTICLES.

COMPLETE AND CONTINUOUS PURIFICATION OF COAL GAS IN CLOSED VESSELS WITHOUT NUISANCE.

By Ernest J. Sutcliffe.

The subject of the complete and continuous purification of coal gas in closed vessels without nuisance, has occupied the attention of gas engineers for many years; but a solution of the problem on a practical scale has not hitherto been obtained. The method to be suggested here is one which it has not, for obvious reasons, been the fortune of the writer to be able to test on a practical scale; but though his premises are mostly deduced from the experiences and experiments of others, and some have not yet advanced even beyond the bounds of theory, he nevertheless believes the plan to be both feasible and practicable.

In a paper on "Purification" which Mr. Charles Hunt read before the Institution of Gas Engineers in May, 1891,* the following passage occurs: "No system of purification can fully satisfy the economic instinct which does not provide for the elimination, in a saleable form, of such impurities as possess a marketable value." The object which the writer has had in view is rather a large one, for it not only includes everything which according to Mr. Hunt would satisfy the economic instinct, but also proposes to restore to its original condition the material used for purification; the whole to be accomplished without nuisance. The plan proposed for the completion of this purpose is a combination of the old system of milk or cream of lime purification, and of the Claus sulphur recovery process. To obtain practical experience in the working of milk of lime purification being out of question at the present day, the opinions of others who have had experience of it, and whose words carry with them great weight, have been observed. It is found that Hughes and Richards ("Gas and

* See "Journal," Vol. LVII., p. 1024.

Gas-Works," p. 163), King ("Treatise on the Manufacture, &c., of Coal Gas," Vol. I., p. 389), Newbigging ("Handbook for Gas Engineers," Fifth Edition, p. 129), G. W. Stevenson ("Report of Proceedings of Committee on Sulphur Compounds in Gas," p. 19), Dr. Edward Frankland (*ibid.*, p. 55), and Dr. Bowditch ("Analysis, &c., of Coal Gas," p. 13) all agree that, except for the nuisance created by the spent material, purification by means of milk of lime was a most valuable and economical method. It will perhaps be well, at the outset, to consider the reactions which occur when the different impurities that are contained in scrubbed coal gas are brought into contact with dry lime and with milk of lime.

Carbonic Acid (CO_2).—The combination which takes place when this impurity and calcium hydrate are brought together, is represented by the equation—

$$CaH_2O_2 + CO_2 = CaCO_3 + H_2O$$

This reaction occurs whether the lime used be in the so-called dry state or as milk of lime; but for some reason or other—probably because of the absorption of the disengaged water by the uncarbonated lime causing aggregation of its particles, and so preventing contact of the carbonic acid with some portion of the lime, thereby hindering chemical action—from 5 to 10 per cent. of the lime used dry is uncarbonated (C. W. Folkard*). When milk of lime is employed, the whole of the calcium hydrate is converted into carbonate.

Sulphuretted Hydrogen (H_2S).—Mr. V. H. Veley, to whom gas engineers are greatly indebted for exhaustive research work on the sulphur compounds of calcium, states† that if sulphuretted hydrogen be passed into water in which lime is suspended, "calcium hydrosulphide is formed, in accordance with the equation—

$$Ca(OH)_2\ x\ Aq. + 2H_2S = Ca(SH)_2 + 2H_2O\ x\ Aq.$$

This substance eventually crystallizes out in white acicular needles. This change is the more perfect the lower the temperature at which it is effected; in fact, a freezing mixture is required for the crystallization of the hydrosulphide. But, in any case, the hydrogen sulphide in excess of that required for the monosulphide is readily evolved by passing into the solution an inert gas such as hydrogen or nitrogen, or even by mere exposure to air. Under any of these conditions, the sparingly soluble hydrated calcium sulphide or calcium hydroxy-hydrosulphide is precipitated in accordance with the reaction—

$$Ca(SH)_2 + H_2O = CaSH,OH + H_2S$$

a change accompanied by the evolution of heat." The results here recorded by Mr. Veley are confirmatory of those of Messrs. Divers and Shimidzu.‡ The two equations just quoted may be combined in one—

$$CaH_2O_2\ x\ Aq. + H_2S + H_2O = CaHOHS + 2H_2O\ x\ Aq.$$

If this reaction occurs when such inert gases as hydrogen or nitrogen (mixed with sulphuretted hydrogen) are used, it is more than probable that the same combination will result when scrubbed coal gas (of which from 40 to 50 per cent. is hydrogen) is passed through the solution. Therefore when gas containing sulphuretted hydrogen is passed through water in which lime is suspended, *one* equivalent of calcium hydrate combines with *one* equivalent of sulphuretted hydrogen, with the formation of *one* equivalent of calcium hydroxy-hydrosulphide.

Working independently of each other with dry slaked lime in the condition in which it is generally used for purposes of purification, Mr. C. W. Folkard§ and the late Professor W. Foster‖ found that only 50 per cent. of the lime was converted into hydroxy-hydrosulphide when sulphuretted hydrogen was passed through it. Mr. Folkard also states¶ that "the fact has been established that in dry lime (as distinguished from milk of lime) purifiers, only half of the lime becomes sulphided." He goes on to say that when solutions of calcium hydrate are used, "lime and sulphuretted hydrogen combine equivalent for equivalent. If I am not mistaken, Mr. Newbigging gives the efficiency of dry lime as only half that of milk of lime. This must refer to its action with sulphuretted hydrogen; for as regards carbonic acid, a dry-lime purifier is nearly as effective as milk of lime, only from 5 to 10 per cent. of the lime being uncarbonated." It is therefore clear that for the removal of sulphuretted hydrogen, dry lime is only half as effectual as milk of lime; and that the compound formed when a gas containing sulphuretted hydrogen is passed through milk of lime is calcium hydroxy-hydrosulphide (CaHOHS).

Carbon Disulphide (CS_2).—Concerning the action which occurs in a box of sulphided lime when a gas containing carbon disulphide, but free from carbonic acid, is passed through it, the consensus of opinion at the present time appears to be that calcium hydroxy-hydrosulphide, or hydrated calcium sulphide, is the material which is active in the removal of the disulphide. Mr. Veley gives** the following equations as representing the reactions occurring—

(1) $2\ CaHOHS + CS_2 = CaH_2O_2, CaCS_3 + H_2S$
(2) $3\ CaHOHS + CS_2 + H_2O = 2\ CaH_2O_2, CaCS_3 + 2\ H_2S$

while Mr. H. Leicester Greville†† states: "I consider that with the ordinary method of sulphiding, the active agent is hydrated calcium sulphide, which, by union with the carbon disulphide, forms calcium sulphocarbonate." Mr. Veley further says:* "Hydrogen sulphide reacts with milk of lime to form the hydrosulphide $Ca(SH)_2$ (*c.f.* Divers and Shimidzu *Journ. Chem. Soc.*, 1884); but this substance was also found to be inert towards carbon disulphide. But if air, or hydrogen, with carbon disulphide vapour (an artificial mixture made to resemble impure gas) be passed through a solution of the hydrosulphide, a considerable quantity of hydrogen sulphide is given off; and, simultaneously with the separation of the hydroxy-hydrosulphide, Ca(OH)(SH), the absorption of the carbon disulphide commenced." There can therefore be no doubt that CaHOHS is always formed when coal gas containing sulphuretted hydrogen is passed through milk of lime; and that this calcium hydroxy-hydrosulphide (CaHOHS), is the substance which eliminates the carbon disulphide from the gas. From the researches of Mr. Veley and Mr. Folkard quoted above, it follows that, if milk of lime is capable of absorbing twice as much sulphuretted hydrogen, with the formation of calcium hydroxy-hydrosulphide, as dry lime, the hydroxy-hydrosulphide produced from a given weight of lime suspended in water will be double the quantity produced if the same weight of lime be used dry, and is therefore capable of eliminating twice as much carbon disulphide as the sulphided dry lime.

Another point worthy of notice is that the results obtained by the method of removing carbon disulphide at present practised are not always reliable. A low temperature prevailing while a dry-lime box is being sulphided, is sufficient to cause the formation of the inactive hydrosulphide (CaH_2S_2), instead of the active hydroxy-hydrosulphide (CaHOHS), which is the product of a higher temperature (H. Leicester Greville† and V. H. Veley above). Keeping up the temperature of the material in a dry-lime purifier while sulphiding is, however, not always practicable; but with a liquid purifying material, the temperature of that liquid could very readily be kept up at any required point. While considering the question of temperature, it may be well to notice a statement which appeared in the "JOURNAL" for Dec. 31, 1895 (p. 1343), in an abstract translation of a prize paper on "The Chemical Purification of Illuminating Gas," by MM. Delseaux and Renard: "Like oxide, lime is more active hot than cold. In the former condition, its action upon carbonic acid is almost twice as great as it is when cold; while its effect upon sulphuretted hydrogen is very considerably augmented. It is the same with the action of sulphide of calcium upon sulphide of carbon; but the former is more easily decomposed by carbonic acid." This statement, in all probability refers to purification by means of dry lime, as is the practice prevalent in modern gas-works. It is doubtful whether equal advantages would be derived from heating milk of lime; but if it were found to be of benefit, the heating could be much more easily effected in the latter system than in dry-lime boxes. Reconciliation of that part of the extract referring to the removal of carbonic acid, with the various published analyses of carbonated lime in this country, is difficult, as the latter show that not more than 10 to 20 per cent. of the lime is uncarbonated. How the lime when heated can absorb twice as much carbonic acid as it could if used cold, when from 80 to 90 per cent. of it is carbonated cold is difficult to imagine.

Now to sum up the capabilities of wet and dry lime for the removal of carbonic acid, sulphuretted hydrogen, and carbon disulphide respectively. Wet lime is wholly carbonated when a gas containing carbonic acid is passed through it. If dry lime be used, from 5 to 10 per cent. at least remains unaltered, and is therefore wasted. With sulphuretted hydrogen, only one-half the quantity retained by wet lime is absorbed by dry lime, with the formation of calcium hydroxy-hydrosulphide (CaHOHS), which is the material active in the elimination of carbon disulphide. Therefore lime sulphided when wet, will absorb twice as much carbon disulphide as the same quantity of lime sulphided dry.

The system of purification proposed consists in using wet lime purifiers in series, in the same manner that dry lime and oxide of iron are commonly employed for complete purification—namely,

1.—Wet lime for the removal of carbonic acid.
2.—Sulphided wet lime for the elimination of carbon disulphide.
3.—Wet lime for the absorption of sulphuretted hydrogen.

The lime solution should be run into the last vessels of the first and third series, in the manner practised when wet-lime purification was formerly in vogue, and flow from these vessels by gravitation into the other vessels of the same series in rotation. From the first or foul purifier of the third or sulphuretted hydrogen series, the sulphided material should be led into the second series as required, any excess being dealt with as directed hereafter. By using the lime in this way, each series of boxes retains the particular impurity it is intended to remove; and a spent material, of fairly definite and regular composition, is produced in each series—namely, calcium carbonate, $CaCO_3$, from the first series; calcium sulphocarbonate, $CaCS_3$ (Greville), $CaH_2O_2CaCS_3$ (Veley), from the second series; and probably both calcium hydroxy-hydrosulphide, CaHOHS, and calcium hydrosulphide, CaH_2S_2, from the third series.

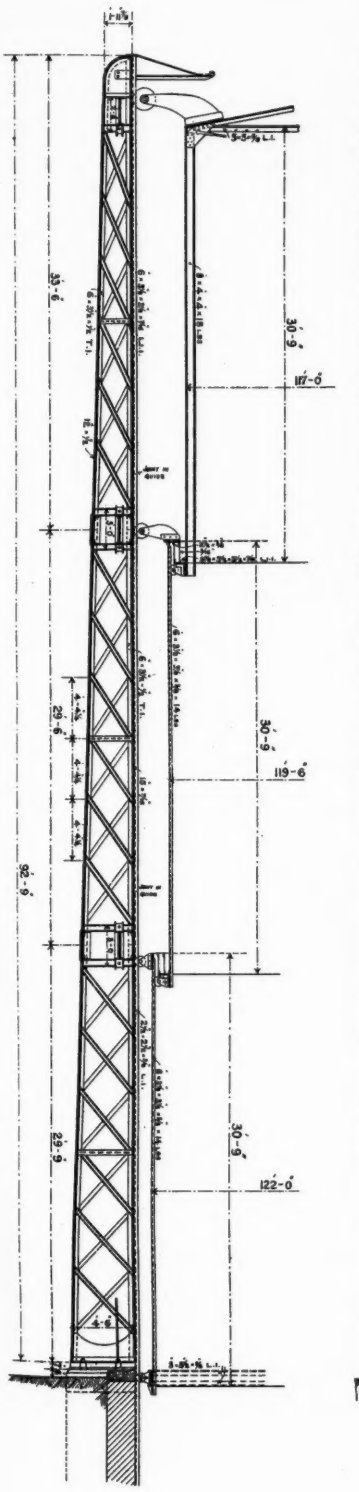
* See "JOURNAL," Vol. XLIV., p. 721.
‡ *Ibid.*, Vol. XLIV., p. 330.
‖ *Ibid.*, Vol. XLIV., p. 586.
** *Ibid.*, Vol. XLVI., p. 827.
† *Ibid.*, Vol. XLVI., p. 827.
§ *Ibid.*, Vol. XLIV., p. 424.
¶ *Ibid.*, Vol. XLIV., p. 721.
†† *Ibid.*, Vol. LIII., p. 383.

* See "JOURNAL," Vol. LXI., p. 22. † *Ibid.*, Vol. LIII., p. 335.

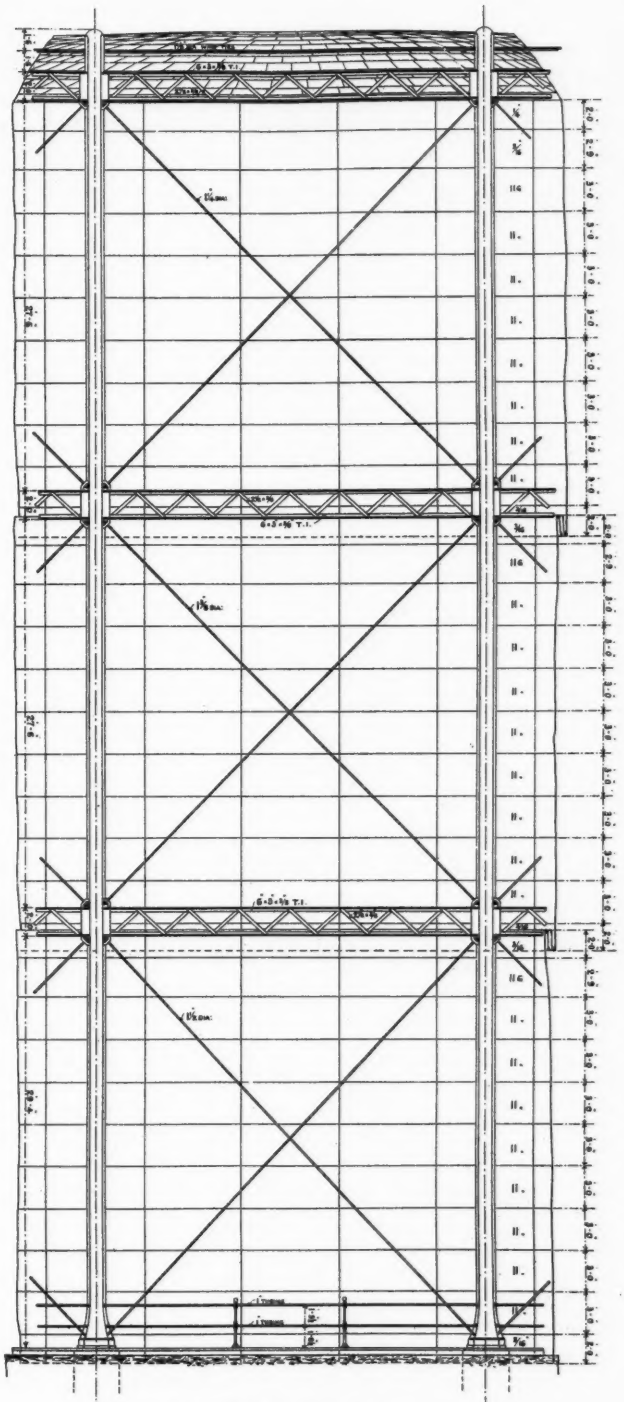
THREE LIFT GASHOLDER — SUTTON GAS-WORKS — Nº 2

ONE MILLION CUBIC FEET CAPACITY

SCALE OF FEET

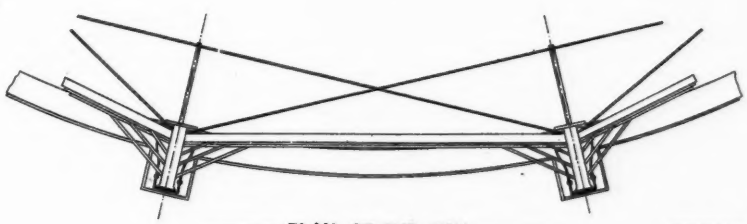


SIDE ELEVATION



ELEVATION OF ONE BAY

14 BAYS



PLAN OF ONE BAY

NOTE!

ALL GIRDERS, TIES &C, TO BE MADE TO THE DEAD LENGTHS AS CALCULATED, AND EVERYTHING MUST BE SET OUT SO AS TO COME TOGETHER PERFECTLY TRUE IN THE ERECTION. —— THE ROLLER PATHS TO BE PERFECTLY STRAIGHT & PLUMB, NOT INCLINING EITHER INWARD OR OUTWARD —— THE BACK FLANGE OF STANDARD MUST BE PERFECTLY STRAIGHT— NOT HAVE AN HOLLOW APPEARANCE —— THE TAPER OF STANDARD IS 9/64 TO 1-0, BEING UNIFORM FROM TOP TO BOTTOM. —— ALL TO BE CONSTRUCTED UNDER COVER & KEPT FREE FROM RUST. —— THE RIVETTING TO BE SET OUT FAIR & TRUE, PARTICULARLY AT END OF LATTICE BARS. —— ⅝ DIAMETER RIVETS TO BE USED THROUGHOUT. —— THE DIAGONAL TIES MUST BE FIXED PERFECTLY STRAIGHT, THE SAG BEING TAKEN OUT BY LIFTING IN THE CENTRE FROM GIRDER ABOVE

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ENTERED AT STATIONERS' HALL.

In recovering the sulphur and lime, it is proposed to treat each of these spent materials separately up to certain points. The spent lime from the carbonic acid boxes may be allowed to settle in suitable tanks, the liquid run off (as calcium carbonate is insoluble), and the mass remaining—which will consist of calcium carbonate and water, and is inodourous—removed to ovens and burnt by any one of the prevailing methods at a high temperature, to drive off the water and carbonic acid. As the material from the first series of purifiers is a pure carbonate, no noxious gases are given off; and the resultant, after burning, consists solely of calcium oxide, and may be used again for purposes of purification. The "blue billy" of The Gaslight and Coke Company was formerly treated in this manner; but the nuisance created by the sulphurous fumes evolved was so great as to necessitate eventually the abandonment of the process.

The product from the last or sulphuretted hydrogen vessels should have the waste gases from the outlet of the oxide purifier of a Claus sulphur-recovery plant blown through it, when the following reaction takes place:—

$$CaHOHS + CO_2 = CaCO_3 + H_2S$$

or, presuming that some calcium hydrosulphide would exist in the spent material, as would probably be found to be the case—

$$CaH_2S_2 + CO_2 + H_2O = CaCO_3 + 2H_2S$$

The sulphuretted hydrogen evolved should be passed into the Claus kiln, and the sulphur thereby recovered; and the material, after drying, decarbonated with that from the carbonic acid purifiers. It would very probably be necessary for the sulphur-recovery plant to be worked in conjunction with the manufacture of sulphate of ammonia, in order to obtain the regular supply of carbonic acid essential for the proper and efficient working of the process.

Two methods of dealing with the residue from the second or carbon disulphide series of purifiers may be resorted to—

1.—Blowing carbonic acid through it, as proposed above; or
2.—Subjecting it to the action of heat.

If the former method be adopted, carbon disulphide and sulphuretted hydrogen are evolved in accordance with the reaction expressed in the equation—

$$CaCS_3 + CO_2 + H_2O = CaCO_3 + CS_2 + H_2S$$

(H. L. Greville), or, using Veley's formula for the sulphocarbonate ($CaH_2O_2\ CaCS_3$)—

$$CaH_2O_2\ CaCS_3 + CO_2 + H_2O = CaH_2O_2 + CaCO_3 + CS_2 + H_2S$$

The gases evolved—carbon disulphide and sulphuretted hydrogen—should be led through a condensing worm, where the disulphide would be deposited in a liquid state, and then conducted into the Claus kiln, where the sulphuretted hydrogen would be decomposed and the sulphur afterwards deposited in the usual manner. The calcium carbonate left should be treated along with that from the carbonic acid purifiers.

Mr. H. Leicester Greville, in treating the spent material from a disulphide box in the manner suggested in the second method—subjecting it to heat—discovered that "by the simple process of distillation" of the compound from the disulphide box "with water, liquid carbon disulphide was obtained with the greatest facility, and in a condition of comparative purity. . . . I found that the residue left after distillation contained from 50 to 60 per cent. of free lime, and absorbed both carbonic acid and sulphuretted hydrogen freely."* As Mr. Greville points out in the article in which he announces his discovery, this result is at variance with Watts's "Dictionary of Chemistry," which states (Vol. V., p. 493) that sulphocarbonates of the alkaline metals and the alkaline earth metals, are easily converted into carbonates by heating their aqueous solutions; water being decomposed and sulphuretted hydrogen evolved—*e.g.*,

$$K_2CS_3 + 3H_2O = K_2CO_3 + 3H_2S.$$

If Mr. Greville's result were found to occur in practice, the evolved gases should be conducted to a condenser in order to deposit the liquid carbon disulphide. In this case, the residue would consist of calcium hydrate, and possibly the hydrosulphide and hydroxy-hydrosulphide also, which could be treated with that from the sulphuretted hydrogen purifiers. If the decomposition spoken of in Watts's "Dictionary" took place, the gases should be led straight into the Claus kiln, in order to convert the sulphuretted hydrogen into free sulphur and water. The residue here would be carbonate of calcium, and should be added to the stock from the carbonic acid boxes.

Among the advantages which this system of purification would present over those now in use, would be—

1.—Complete purification of gas from carbonic acid, sulphuretted hydrogen, and carbon disulphide in closed vessels without nuisance; and consequent saving in gas and illuminating power.
2.—Great reduction of labour resulting rom the adoption of a system of purification by means of liquids.
3.—Recovery of all the sulphur contained in the gas in a marketable form, and without nuisance.
4.—Restoration to its original condition of the lime used for purification, resulting in a great saving in material.

The only disadvantages which can be seen to result from the working of this process are—

1.—Increased pressure caused by the purifiers.
2.—Increased supervision necessary in the recovery of the lime and sulphur, may be so regarded by some.

* See "JOURNAL," Vol. XLII., p. 1055.

THE THREE-LIFT GASHOLDER AT SUTTON.

WITH REMARKS ON CONSTRUCTION.

By F. S. CRIPPS, Assoc.M.Inst.C.E.

II.—*The Guide-Framing.*

It will be observed that the guide-framing in this gasholder is carried to the *full height*—that is, none of the lifts rise above the guide-framing when the holder is fully inflated. The reason for this is that, after giving very careful consideration to the advantages claimed for reducing the height of the guide-framing, it is found that the saving in first cost (if any) is very trifling; whereas the constant strain and wear and tear are increased, and the stability diminished. As regards cost, it is well known that in many instances the cost of the ordinary construction has been considerably less than that of the reduced guide-framing type of gasholder. And more than this, it is not at all unusual that the price asked for a gasholder without any guide-framing at all, exceeds that for one having guide-framing carried to the full height.

A few remarks on the reduction in the height of gasholder guide-framing may be of interest. It was first suggested by Mr. George Livesey in 1881, and tried with success in 1888 at Rotherhithe, by adding a new lift to an existing telescope gasholder without raising the framing. When the large gasholder at Kennington Lane was doubled in size (1890), the guide-framing was only raised to the height of three lifts, the fourth being allowed to go free. And in the case of Mr. Livesey's 12-million holder at East Greenwich (1891), two lifts out of six extend above the guide-framing, when fully inflated.

In all these examples the roller carriages are retained on the inner lifts, so that they are not lacking in horizontal support until they actually quit the guides, which is not before there is plenty of hanging weight, and sufficient wheel base in the combined other lifts, to prevent undue strain and tilting.

There are several other examples of gasholders with one or two lifts free, some of which are constructed on the wire-rope or spiral-guide systems, in which the ordinary rollers on the free lifts are dispensed with. But where the guide-framing is lowered, there is no doubt that the best and most economical way is to retain all the roller carriages on Mr. Livesey's plan, without any special devices beyond perhaps spreading or shaping the top of the standard guides to facilitate the re-entry of the top rollers into the guides when the holder descends. If the top rollers be abolished, what it means is this: That after the inner lift has cupped with the next one, it towers above all points from which it can get support in a horizontal direction, and therefore sways over, springing the guides, roller-carriages, and cups on the other lifts, to a most dangerous extent, sometimes causing the cup to get several inches out of level. The raising of the centre of gravity of the lifted mass far above the points of horizontal support, brings enormous leverage to bear, and increases the strains on the middle and next lifts, necessitating much additional stiffness and strength in these parts, together with tangential rollers or their equivalent. It is important to emphasize this point, as several mistakes have already been made in the design of such holders, involving considerable expense to rectify them afterwards.

If the guide-framing stop short, it must in any case be made stronger; and the gasholder itself needs extra strength and stiffness. So that when all is said and done there is little, if any, saving in price, and certainly no improvement in the appearance strength, or durability.*

[It may be mentioned that the question of reduction of guide-framing, and the principles of construction to be observed, together with the strains on all parts of a gasholder due to such a system, were given in the writer's "Guide-Framing of Gasholders," first published in 1887. The rules, however, refer to gasholders having the ordinary roller carriages as recommended in the above article, and not to any special systems of guiding, which at that time were not invented. This is mentioned to prevent anyone blindly following the formulæ without making the necessary modifications to suit such systems].

For these reasons, as before stated, the ordinary plan of carrying the standards up to the *full height* of the holder has been retained in the design now under consideration.

Generally, it will be seen from the Drawing No. 2 that the guide-framing consists of 14 framed standards, united by three tiers of girders and diagonal ties, with wind-ties at the top to connect the alternate standards.

Fourteen standards were selected, as being the nearest even number which would give a convenient length for the girders and gasholder bays—viz., about 28 feet centres, and (what is of importance) not so far apart as to cause the girders or ties to foul the gasholder. Of course, the larger the gasholder the further the standards can be spread apart without running this risk. Three tiers of girders are adopted, because the standards can then be made in convenient lengths (about 30 feet each) for handling, and are about as long as it would be safe to have them, without making the section of a more expensive design.

The detailed description of the guide-framing of this holder is reserved until the details appear next week (Drawing No. 3), so that the two drawings may be referred to together.

TECHNICAL RECORD.

INSTITUTION OF GAS ENGINEERS.

Programme of the Forthcoming General Meeting.

We have received from the Secretary of the above-named Institution (Mr. Thomas Cole) an advance copy of the programme of the forthcoming general meeting, which is to take place in London on the 14th prox. and two following days. The business will be transacted at the Royal United Service Institution, under the presidency of Mr. G. E. Stevenson, of Manchester. After the routine matters which usually first engage attention have been disposed of, the President will deliver his Inaugural Address. The Committee on Standards of Light and Temperature of Gas Measurement will report on the matters referred to them; and then the technical business will be taken. The following is a list of the papers: "High-Pressure System of Distribution," by Fletcher W. Stevenson. "Inclined Retorts," by E. Drory. "A Modern Gas-Works," by F. D. Marshall. "The Standard Ten-Candle Lamp," by Professor A. G. Vernon Harcourt. "The Two-Candle Standard," by E. L. Pryce. "A New Departure in Carbonizing," by S. Glover. "Washers and Scrubbers," by E. A. Harman.

The annual dinner of the Institution will be held at the Trocadero Restaurant on the evening of the first day of the meeting; and the third day will be devoted to an excursion down the river. The members and their guests of the Dutch Institution of Gas Engineers will start from Westminster Bridge and proceed to the Beckton Gas-Works, where the coal-discharging apparatus will be inspected. After luncheon on board the steamer, the party will cross the river to East Greenwich, where they will be shown over the works of the South Metropolitan Gas Company. On leaving, they will be conveyed to Greenwich, whence they will proceed by train to the Crystal Palace, where there will be a banquet.

THE INCORPORATED GAS INSTITUTE.

Programme of the Forthcoming Annual Meeting in Belfast.

We have received the official programme of the thirty-fifth annual general meeting of the Incorporated Gas Institute, which, as previously intimated in the "JOURNAL," is to be held in Belfast from the 21st to the 23rd prox., under the presidency of Mr. J. Stelfox, M.Inst.C.E., the Gas Engineer to the Corporation of that city. The meetings will be held in the Exhibition Hall at the Botanic Gardens Park.

The first day's proceedings will open with a welcome by the Right Hon. the Lord Mayor of Belfast (Alderman J. Henderson, M.A., J.P.), after which the usual introductory business of the meeting will be proceeded with. This will include the presentation of the report and accounts. The former commences, as usual, with statistics of membership; and it is stated that at the close of last year there were 656 names upon the register, consisting of 19 honorary, 493 ordinary, 33 extraordinary, and 52 associate members, and 59 associates. At the annual meeting, there were 53 additions to the roll, and two transferences to the class of members. On the other hand, 21 names have been removed. The Institute have lost seven members by death since their last report—viz., Mr. S. Bark, of Godalming; Mr. Allan Brown, of Woodford; Mr. T. R. Crook, of Portsea; Mr. G. Eskholme, of Rotherham; Mr. R. Mitchell, of Edinburgh; Mr. J. S. Nicholls, of Darlington; and Mr. J. Weir, of Melbourne. Referring to the financial position of the Institute, the Council point to the fact that the revenue account shows a balance of £170, which is the largest surplus since the year 1887. This cannot, they say, but be regarded as a matter for special congratulation; proving, as it does, that substantial progress continues to be made. After reviewing the work of the meeting at Bath last year, under the presidency of Mr. C. Stafford Ellery—specially interesting features of which were the despatch of a telegram of congratulation to Her Majesty the Queen on the approaching completion of the sixtieth year of her reign, and the presentation of the Birmingham Medal to Dr. Auer von Welsbach—the Council state that the premiums for papers read on that occasion have been awarded as follows: First (with the President's Medal), to Mr. J. Stelfox, for his paper on "Experiments with the Claus System of Purification at Belfast;" second, to Mr. Isaac Carr, for his paper on "Taxation of Gas by Local Authorities;" third, to Mr. W. R. Chester, for his paper on the "Automatic Regulation of Pressure in the Distributing-Mains." These premiums having been presented, the address by the President will follow; and then the technical business will be taken.

The following is the list of papers: "The Standardizing of Meter-Unions," by R. S. Carlow, of Arbroath. "The Necessity for Amendments in the Gas Clauses Acts," by W. F. Cotton, of Dublin. "The Influence of Carbonic Acid on the Combustion of Coal and Water Gas," by F. G. Dexter, of Winchester. "The Workmen's Compensation Act, 1897, as Affecting Gas Companies," by C. Stafford Ellery, of Bath. "The Construction of, and Mode of Working Purifiers" by Mr. H. Green, of Preston. "The Valuation of Gas-Works for Assessment," by William Newbigging, of Manchester. "Village Lighting—A Comparison," by R. G. Shadbolt, of Grantham. "Laboratory Notes: Gas Analysis, &c.," by J. T. Sheard, of Sheffield. "Inclined Retorts at Salford," by S. Y. Shoubridge, of Sydenham. In addition to these, Professor Vivian B. Lewes, F.I.C., F.C.S., will deliver a lecture on "Acetylene and its Latest Developments."

Arrangements have been made for visiting the most important works in the city; and there will be a special turnout of the Fire Brigade in the afternoon of the second day of the meeting; Friday, the 24th, will be devoted to an excursion to Rostrevor and Warrenpoint, *via* Newcastle (Co. Down) and the Mourne Mountain road, with luncheon at the Mourne Hotel at the first-named place. During the meeting, there will be a display of the Welsbach Company's new burner in the Ulster Hall, under the direction of Mr. J. H. Sheldrake; the morning of Saturday, June 25, being reserved exclusively for members of the Institute.

THE REVISED INSTRUCTIONS OF THE METROPOLITAN GAS REFEREES.

The new Instructions in regard to the testing of gas which have for some time been in preparation by the Metropolitan Gas Referees—Mr. C. Vernon Boys, Professor A. G. Vernon Harcourt, and Dr. W. Pole—have been issued, and we give below those portions in which changes have been made.

The opening paragraphs set forth, as before, the various Acts of Parliament under which the Referees were appointed, and the duties they have to discharge; and then comes the list of testing-places—23 in number—for the three Metropolitan Gas Companies. The Instructions then proceed as follows:—

As to the Standard Lamp to be Used for Testing Illuminating Power.

The standard to be used in testing the illuminating power of gas shall be a pentane 10-candle lamp which has been examined and certified by the Gas Referees. A description of the lamp is given in Appendix A. The residue of pentane in the saturator shall, at least once in each calendar month, be removed. It shall not be used again in any testings. The pentane to be used in this lamp shall be prepared as described in Appendix B, and shall show when tested the properties there specified. All pentane provided by the Gas Companies will be examined and certified by the Gas Referees, and will be sent to the testing-places in pint cans which have been both sealed and labelled by them; and no pentane shall be used in the testing-places other than that which has been thus certified.

As to the Times and Mode of Testing for Illuminating Power.

The testings for illuminating power are to be three in number daily, as in the previous Instructions; but if their average falls below the prescribed illuminating power, a fourth testing is to be made. The Referees then proceed to give the following directions as to testing:—

The photometer to be used in the testing-places shall be the Table Photometer described in Appendix C. The air-gas in the lamp is to be kept burning so that the flame is near its proper height for at least ten minutes before any testing is made. At the completion of every testing, the air-gas is to be turned out; but, if the interval between two testings does not much exceed one hour, and the Gas Examiner is present during the interval, he may, instead of turning it out, turn it down low.

The gas-burner attached to each photometer shall be a standard burner corresponding to that which has been deposited with the Warden of the Standards, in accordance with, among others, section 37 of The Gaslight and Coke Company Act, 1876. A description of the standard burner to be used for testing gas is given in Appendix D. Each burner shall bear a distinctive number. No burner shall be used for testing the illuminating power of gas that does not bear the lead seal of the Referees. A clean chimney is to be placed on the burner before each testing.

The gas under examination is to be kept burning, so that the flame is about the usual height, for at least 15 minutes before any testing is made; and no gas shall pass through the meter attached to the photometer except that which is consumed by the standard burner in testing or during the intervals between the testings made on any day, and that which is used in proving the meter.

The paper used in the photoped of the photometer shall be white in colour, unglazed, of fine grain, and free from watermarks. It shall be as translucent as is possible consistently with its being sufficiently opaque to prevent any change in the apparent relative brightness of the two portions of the illuminated surface when the head is moved to either side. This paper should, when not in use, be covered to protect it from dust; and if it has been in any way marked or soiled, a fresh piece is to be substituted.

Each testing shall be made as follows: The index of the regulating-tap shall be so turned that the gas-flame gives rather less light on the photoped than the standard, and shall then be gradually turned on until equal illumination has been obtained. The position of the index shall then be noted. Next, the tap shall be so turned that the gas-flame appears to give

rather more light than the standard, and shall then be turned off until equality is again attained, and the position of the index shall be again noted. The double operation shall be repeated. The mean of the four index positions shall be taken as that which gives true equality of illumination. The index shall be set to this mean position, the equality of illumination verified, and the time that the hand of the meter takes to make two complete evolutions shall be observed.

In order to make this observation, a stopclock shall be used by which the time which has elapsed since the clock was started can be read with an accuracy of at least half a second. The clock shall be started at the moment when the meter-hand points either to zero or to some other convenient mark, and a note shall be immediately made of the mark chosen. Exactly at the completion of the second turn of the meter-hand, the Gas Examiner shall stop the clock. The time of two revolutions thus indicated by the clock is to be read to the nearest half second, and found in the table given in Appendix E. From this and the reading of the aerorthometer, or a determination of the tabular number, the illuminating power of the gas is to be obtained, either directly or by interpolation. Only one figure after the decimal point need be entered when the result is above 16; where a lower result is found, both figures should be noted and entered. A table giving the tabular numbers for different temperatures and pressures is given in Appendix F.

The method of finding the illuminating power from the table by interpolation may be illustrated by the two following examples:—

I.—Time, 1 min. 53 sec. Reading of aerorthometer, 1·073. By the table, the illuminating power corresponding to this time of consumption and to the reading 1·070 is 16·12, while for the reading 1·080 it is 16·27. Thus, in this part of the scale, when the reading is 10 degrees higher, the illuminating power is greater by 0·15 candle. Hence, when the reading is 3 degrees above 1·070, the corresponding illuminating power is $16{\cdot}12 + \frac{3}{10} \times 0{\cdot}15 = 16{\cdot}165$ candles, and the number to be returned is 16·2.

II.—Time, 2 min. 1½ sec. Reading of aerorthometer, 0·984. The numbers in the table under 0·890 are 15·81 for 2 min. 1 sec., and 15·94 for 2 min. 2 secs. Therefore the number corresponding to 1½ sec. is the half-way number, 15·875. The number found similarly under 0·990 is 16·035. The increase for 10 degrees is here 0·16; the number corresponding to the reading 0·984 is accordingly $15{\cdot}875 + \frac{4}{10} \times 0{\cdot}16 = 15{\cdot}939$, and the number to be returned is 15·94.

If, in very exceptional circumstances, aerorthometer scale or the tables do not include the conditions that are met with, the Gas Examiner shall determine the illuminating power by means of one or other of the formulæ printed below the tables.

[The remaining Instructions under this head are unaltered.]

As to the Times and Mode of Testing for Purity.

The testings for purity shall extend over not less than 15 hours of each day, and shall be made upon 10 cubic feet of gas. The gas shall be tested successively for sulphuretted hydrogen, ammonia, and sulphur compounds other than sulphuretted hydrogen, in the manner hereinafter prescribed. These testings must be started between 9 a.m. and 5 30 p.m., and must be concluded before 9 a.m. on the following morning. They are concluded by the action of an automatic lever-tap attached to the meter, which stops the passage of the gas when 10 cubic feet have passed. A clock connected with the lever-tap is stopped at the same moment, leaving a record of the time; and the tap of an aerorthometer is turned, leaving a record of the final conditions under which the gas was measured by the meter. The liquids in the sulphur and ammonia tests, and the slips of paper in the tests for sulphuretted hydrogen then contain the sulphur and ammonia which were present in the gas supplied to the testing-place during the day which ended at 9 a.m. The chemical examination of these liquids may be made on the following day—that is to say, after 9 a.m.*

I.—*Sulphuretted Hydrogen.*

The gas shall be passed as it leaves the service-pipe through a small governor, and thence through an apparatus in which are suspended slips of bibulous paper, impregnated with basic acetate of lead. A description of this apparatus is given in Appendix G.

The test paper from which these slips are cut is to be prepared, from time to time, by moistening sheets of bibulous paper with a solution of one part of sugar of lead in eight or nine parts of water, and holding each sheet while still damp over the surface of a strong solution of ammonia for a few moments. As the paper dries all free ammonia escapes. If distinct discoloration of the surface of the test-paper is found to have taken place, this is to be held conclusive as to the presence of sulphuretted hydrogen in the gas. Fresh test-slips are to be placed in the apparatus every day.

In the event of any impurity being discovered, one of the test-slips shall be placed in a stoppered bottle, and kept in the dark at the testing-place; the remaining slips shall be forwarded with the daily report.

II.—*Ammonia.*

The gas which has been tested for sulphuretted hydrogen shall pass next through an apparatus consisting of a glass cylinder filled with glass beads, which have been moistened with a measured quantity of standard sulphuric acid. A set of burettes, properly graduated, is provided.

The maximum amount of ammonia allowed is 4 grains per 100 cubic feet of gas; and the examination of the liquid shall be made so as to show the exact amount of ammonia in the gas. Two test solutions are to be used—one consisting of dilute sulphuric acid of such strength that 25 measures (septems) will neutralize 1 grain of ammonia; the other a weak solution of ammonia, 100 measures of which contain 1 grain of ammonia.

The correctness of the result to be obtained depends upon the fulfilment of two conditions: (1) The preparation of test solutions having the proper strength; (2) the accurate performance of the operation of testing.

To prepare the test solutions, the following processes may be used by the Gas Examiner: Measure a gallon of distilled water into a clean earthenware jar or other suitable vessel. Add to this 94 septems of pure concentrated sulphuric acid, and mix thoroughly. Take exactly 50 septems of the liquid, and precipitate it with barium chloride in the manner prescribed for the sulphur test. The weight of barium sulphate which 50 septems of the test acid should yield is 13·8 grains. The weight obtained with the dilute acid prepared as above will be somewhat greater, unless the sulphuric acid used had a specific gravity below 1·84. Add now to the diluted acid a measured quantity of water, which is to be found by subtracting 13·8 from the weight of barium sulphate obtained in the experiment, and multiplying the difference by 726. The resulting number is the number of septems of water to be added.

If these operations have been accurately performed, a second precipitation and weighing of the barium sulphate obtainable from 50 septems of the test acid will give nearly the correct number of 13·8 grains. If the weight exceeds 13·9 grains, or falls below 13·7 grains, more water or sulphuric acid must be added, and fresh trials made, until the weight falls within these limits. The test acid thus prepared should be transferred at once to stoppered bottles which have been well drained and are duly labelled.

To prepare the standard solution of ammonia, measure out as before a gallon of distilled water, and mix with it 50 septems of strong solution of ammonia (sp. gr. ·88). Try whether 100 septems of the test alkali thus prepared will neutralize 25 of the test acid; proceeding according to the directions given subsequently as to the mode of testing. If the acid is just neutralized by the last few drops, the test alkali is of the required strength. But, if not, small additional quantities of water, or of strong ammonia solution, must be added, and fresh trials made, until the proper strength has been attained. The bottles in which the solution is stored should be filled nearly full and well stoppered.

The mode of proceeding is as follows: Take 50 septems of the test acid (which is greatly in excess of any quantity of ammonia likely to be found in the gas), and pour it into the glass cylinder, so as to well wet the whole interior surface, and also the glass beads. Connect one terminal tube of the cylinder with the gas supply, and the other with the meter, and make the gas pass at a rate of not more than two-thirds of a cubic foot per hour. Any ammonia that is in the gas will be arrested by the sulphuric acid and a portion of the acid (varying with the quantity of ammonia in the gas) will be neutralized thereby. At the end of each period of testing, wash out the glass cylinder and its contents with distilled water, and collect the washings in a glass vessel. Transfer one-half of this liquid to a separate glass vessel, and add a quantity of a neutral solution of litmus, or other indicator in ordinary use, just sufficient to colour the liquid. Then pour into the burette 100 septems of the test alkali, and gradually drop this solution in the measured quantity of the washings, stirring constantly. As soon as the colour changes (indicating that the whole of the sulphuric acid has been neutralized), read off the quantity of liquid remaining in the burette. To find the number of grains of ammonia in 100 cubic feet of gas, multiply by 2 the number of septems of test alkali remaining in the burette, and move the decimal point one place to the left.

The remaining half of the liquid is to be set aside, in case it should be desirable to repeat the volumetric analysis. This portion of the liquid is to be used in either of the two following cases: (1) If the analysis of the first portion of the liquid show an excess of impurity, the Gas Examiner shall forthwith give the notice provided for in the Acts of Parliament (The Gaslight and Coke Company Act, 1876, sec. 40, and others); and if the Company think fit to be represented by some officer, the second portion of the liquid shall be examined in his presence. (2) If the analysis of the first portion of the liquid should miscarry, or the Gas Examiner have any reason to distrust the result, he shall be at liberty to make an analysis of the second portion, provided that before doing so he give notice to the Company, in order that they may, if they think fit, be represented by some officer. Unless thus used, it is to be preserved, in a bottle properly labelled, for a week.

III.—Measurement of Gas and of the Rate of Flow.

The gas which has been tested for sulphuretted hydrogen and ammonia shall pass next through a meter by means of which the rate of flow can be adjusted, and which is provided with a self-acting movement for shutting off the gas when 10 cubic feet have passed, for stopping a clock so as to indicate the time at which the testings terminated, and for turning the tap of the

* The gas-testing day begins at 9 a.m. of one civil day, and terminates at 9 a.m. of the next. The date is that of the civil day on which it begins. (The City of London Gas Acts, 1868, section 2.)

recording aerorthometer. The Gas Examiner shall enter in his book the time thus indicated, as also the time at which the testings began.

The clock required is a good pendulum clock, with a wire passing transversely through the case behind the pendulum. Outside the case a lever arm is clamped to the wire, so that when liberated the arm will drop and turn the wire. Inside the case an arm is clamped to the wire, and at the end of the arm a flexible wire is fastened. When the lever drops, this flexible wire is brought into gentle frictional contact with the pendulum, so as to stop it without shock.

The clock should be wound from the front, and both hands should be mounted so that they can be set independently also from the front. It is desirable that the clock should be able to go for a week with one winding.

IV.—*Sulphur Compounds other than Sulphuretted Hydrogen.*

The testing shall be made in a room where no gas is burning other than that which is being tested for sulphur and ammonia. A description of the apparatus to be employed is given in Appendix H.

Pieces of sesquicarbonate of ammonia, from the surface of which any efflorescence has been removed, are to be placed round the stem of the burner. The index of the meter is to be then turned forward to the point at which the catch falls and will again support the lever-tap in the horizontal position. The lever is then made to rest against the catch, so as to turn on the gas. The index is then turned back to a little short of zero, and the burner lighted. When the index is close to zero, the trumpet-tube is placed in position on the stand, and its narrow end connected with the tubulure of the condenser. At the same time the long chimney-tube is attached to the top of the condenser.

As soon as the testing has been started, a reading of the aerorthometer is to be made and recorded. The mechanism for stopping the clock is then to be connected with the lever-tap of the meter, so that both may be stopped at the same moment when 10 cubic feet of gas have passed through the meter. The time at which the testing begins is to be recorded.

After each testing, the flask or beaker which has received the liquid products of the combustion of the 10 cubic feet of gas, is to be emptied into a measuring cylinder, and then replaced to receive the washings of the condenser. Next the trumpet-tube is to be removed and well washed out into the measuring cylinder. The condenser is then to be flushed twice or thrice by pouring quickly into the mouth of it 40 or 50 c.c. of distilled water. These washings are brought into the measuring cylinder, whose contents are to be well mixed and divided into two equal parts.

One-half of the liquid so obtained is to be set aside, in case it should be desirable to repeat the determination of the amount of sulphur which the liquid contains. This portion is to be examined under the same conditions as have been prescribed for the examination of the second portion of the liquid obtained from the apparatus used in testing for ammonia. Unless thus previously used, it is to be preserved, in a bottle properly labelled, for one week.

The remaining half of the liquid is to be put into a flask, or beaker covered with a large watch-glass, treated with hydrochloric acid sufficient in quantity to leave an excess of acid in the solution, and then raised to the boiling-point. An excess of a solution of barium chloride is now to be added, and the boiling continued for five minutes. The vessel and its contents are to be allowed to stand till the barium sulphate settles at the bottom of the vessel, after which the clear liquid is to be as far as possible poured off through a paper filter. The remaining liquid and barium sulphate are then to be poured on to the filter, and the latter is to be well washed with hot distilled water. (In order to ascertain whether every trace of barium chloride and ammonium chloride has been removed, a small quantity of the washings from the filter should be placed in a test-tube, and a drop of a solution of silver nitrate added. Should the liquid, instead of remaining perfectly clear, become cloudy, the washing must be continued until on repeating the test no cloudiness is produced.) Dry the filter with its contents, and transfer it into a weighed platinum crucible. Heat the crucible over a lamp, increasing the temperature gradually, from the point at which the paper begins to char up to bright redness.* When no black particles remain, allow the crucible to cool; place it when nearly cold in a dessicator over strong sulphuric acid; and again weight it. The difference between the first and second weighings of the crucible will give the number of grains of barium sulphate. Multiply this number by 11 and divide by 4; the result is the number of grains of sulphur in 100 cubic feet of the gas.

This number is to be corrected for the variations of temperature and atmospheric pressure in the manner indicated under the head of "Illuminating Power," with this difference—that the mean of the aerorthometer readings found at the beginning and at the end of any testing shall be taken as the reading for that testing. The reading at the beginning of the testing is to be made by the Gas Examiner, who before leaving the testing-place will set the columns of mercury level in the two tubes of the instrument, and will connect the lever-tap of the aerorthometer with that of the meter. The fall of the lever of the meter will release a similar lever turning a tap which closes the tube of the aerorthometer. The reading of the aerorthometer as it stood at the end of the testing will require a small correction for the difference in level of the mercury in the two tubes, which is to be made in the following manner.

Let R be the corrected reading, r_1 the actual reading of the aerorthometer, r_2 the reading of the companion tube, h the mean height of the barometer in units of the aerorthometer scale, a figure which will be printed on each instrument. Then

$$R = r_1 \times \frac{h \times r_1 - r_2}{h}$$

The correction by means of the aerorthometer reading may be made most simply and with sufficient accuracy in the following manner.

When the aerorthometer reading is between	·955-·965,	·966-·975,	·976-·985,	·986-·995,	
Diminish the number of grains of sulphur by	4,	3,	2,	1	per cent.

When the aerorthometer reading is between ·996-1·005, no correction need be made.

When the aerorthometer reading is between	1·006-1·015,	1·016-1·025,	1·026-1·035,	
Increase the number of grains of sulphur by	1,	2,	3	per cent.

Example.—Grains of barium sulphate from 5 c. ft. of gas . . . . . 4·3

Multiply by 11 and divide by 4. 11 — Aerorthometer reading 1·018

4)47·3

Grains of sulphur in 100 c. ft. of gas (uncorrected). . . . 11·82

Add 11·8 × $\frac{1}{100}$ = . . ·24

Grains of sulphur in 100 c. ft. of gas (corrected) . . . . . 12·06 Result: 12·1 grs.

The aerorthometer reading is the reciprocal of the tabular number. The Gas Examiner shall, not less often than once a month, compare the aerorthometer reading with the reciprocal of the tabular number deduced from observations of the barometer and thermometer; and if there is a difference of more than 0·5 per cent., the instruments are to be readjusted.

Until any testing-place has been provided with the recording instruments hereby prescribed for use, and until the instruments thus provided have been examined and certified by the Gas Referees, the testings are to be continued as heretofore.

MODE OF TESTING THE PRESSURE AT WHICH GAS IS SUPPLIED.

The Instructions hitherto in force have not been altered in this respect.

METERS.

Each of the meters used for measuring the gas consumed in making the various testings is constructed with a measuring drum which allows 1·12th of a cubic foot of gas to pass for every revolution. A hand is fastened directly to the axle of this drum, and passes over a dial divided into 100 equal divisions. The dial and hand are protected by a glass. In the meter employed in testing the purity of gas, the pattern of dial for showing the number of revolutions and the automatic cut-off hitherto in use shall be retained; but in the meter employed for testing illuminating power, only the dial above described is needed. The stop-clock may be either attached to the meter or separate.

The meters used for measuring the gas consumed in making the various testings, having been certified by the Referees, shall, at least once in seven days, be proved by the Gas Examiners by means of the Referees' 1·12th of a cubic foot measure. A description of this instrument, with directions how to use it, is given in Appendix L.

No meter other than a wet meter shall be used in testing the gas under these Instructions.

MAXIMUM AMOUNTS OF IMPURITY.

These remain as before. All gas supplied must be wholly free from sulphuretted hydrogen; the maximum amount of ammonia will be 4 grains, and of sulphur 17 and 22 grains for the summer and winter seasons respectively.

APPENDIX A.

THE TEN-CANDLE PENTANE LAMP.

Mr. Harcourt's ten-candle pentane lamp is one in which air is saturated with pentane vapour, and in which the air-gas so formed descends by its gravity to a steatite ring-burner. The flame is drawn into a definite form; and the top of it is hidden from view by a long brass chimney above the steatite burner. The chimney is surrounded by a larger brass tube, in which the air is warmed by the chimney, and so tends to rise. This makes a current which, descending through another tube, supplies air to the centre of the steatite ring. No glass chimney is required. No exterior means have to be employed to drive the pentane vapour through the burner.

Fig. 1 shows the general appearance of the lamp. The saturator A is, at starting, about two-thirds filled with pentane.*

* An equally good and more expeditious method is to drop the filter with its contents, drained but not dried, into the red-hot crucible.

* CAUTION.—Pentane is extremely inflammable. It gives off at ordinary temperatures a heavy vapour, which is liable to ignite at a flame at a lower level than the liquid. *The saturator must never be filled up with pentane when in position, if the lamp is alight.*

It should be replenished from time to time so that the height of liquid as seen against the windows may not fall below one-eighth of an inch. The saturator A is connected with the burner B by means of a piece of wide india-rubber tube. The rate of flow of the gas can be regulated by the large stopcock S^2. The large stopcock S^1 for admitting air should be fully open when the lamp is in use. Both should be turned off when the lamp is not alight.

The chimney tube C should be turned or screened so that no light passing through the mica window near its base can fall upon the photoped. The lower end of this tube should, when the lamp is cold, be set 47 mm. above the steatite ring-burner. A cylindrical boxwood gauge, 47 mm. in length and 32 mm. in diameter, is provided with the lamp, to facilitate this adjustment. The exterior tube D communicates with the interior of the ring-burner by means of the connecting box above the tube E and the bracket F on which the burner B is supported. A

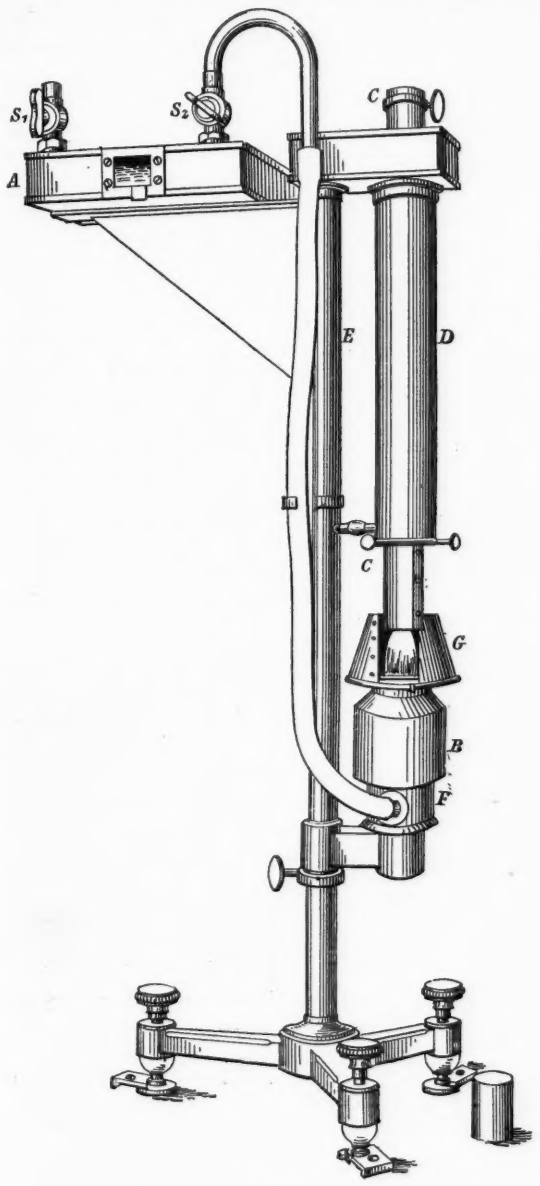


FIG. 1.

conical shade G is provided. This should be placed so that the whole surface of the flame beneath the tube C may be seen at the photoped through the opening.

The lamp should be adjusted, by its levelling screws, so that the tube E (as tested with a plumb-line) is vertical, and so that the upper surface of the steatite burner is 453 mm. from the table. A gauge is provided to facilitate this latter measurement. The tube C is brought centrally over the burner by means of the three adjusting screws at the base of the tube D. This adjustment is facilitated by means of the boxwood gauge.

When the lamp is in use, the stop-cock S^2 is to be turned so that the tip of the flame is about half-way between the bottom of the mica window and the cross-bar. A variation of a quarter of an inch either way has no material influence upon the light of the flame.

The following are the more important dimensions on which the precision of the lamp depends; but no departure should be made from any of the dimensions as shown by the working drawings. All dimensions are given in millimetres.

SATURATOR A.—184 × 184 × 38 deep, inside measurement, with seven partitions alternately meeting either side, and stopping 25 short of the opposite side, to cause the air to pass eight times across the box. These partitions must be soldered to the top, not to the bottom of the box.

SIPHON TUBE FROM SATURATOR.—Outer diameter, 14 ($\frac{1}{2}$-inch [full).

INDIA RUBBER TUBE.—Inner diameter, 13 ($\frac{1}{2}$-inch).

STEATITE BURNER.—Outer diameter, 24; inner diameter, 14; 30 holes, each 1·25 in diameter.

BRASS CHIMNEY C.—Outer diameter, 32; inner diameter, 30; length, 431.

BRASS OUTER TUBE D.—Outer diameter, 52; inner diameter, 50; length, 290.

CHIMNEY C projects 65 below and 76 above the tube D.

BRASS TUBE E.—Outer diameter, 25; inner diameter, 23; length, 529½.

DISTANCE between axis of tube E and axis of tubes C and D, 67.

SHADE G.—Diameter of base, 102; diameter at top, 55; height, 57; opening, 38 within, 34 without.

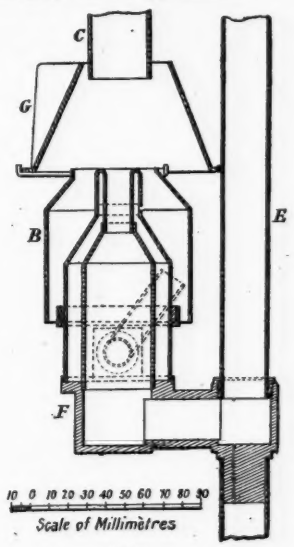


FIG. 2.

The structure of the actual burner is shown in the sectional drawing, fig. 2.

APPENDIX B.

The pentane to be used in the 10-candle lamp should be prepared and tested in the following manner.

PREPARATION.—Light American petroleum, such as is known as gasoline and used for making air-gas, is to be further rectified by three distillations, at 55° C., 50° C., and 45° C. in succession. The distillate at 45° C. is to be shaken up from time to time, during two periods of not less than three hours each, with one-tenth its bulk of (1) strong sulphuric acid, (2) solution of caustic soda. After these treatments it is to be again distilled, and that portion is to be collected for use which comes over between the temperatures of 25° and 40° C. It will consist chiefly of pentane, together with small quantities of lower and higher homologues whose presence does not affect the light of the lamp.

TESTING.—The density of the liquid pentane at 15° C. should not be less than 0·6235 nor more than 0·626 as compared with that of water of maximum density. The density of the pentane when gaseous, as compared with that of hydrogen at the same temperature and under the same pressure, may be taken. This is done most readily and exactly by Gay Lussac's method, under a pressure of about half an atmosphere, and at temperatures between 25° and 35° C. The density of gaseous pentane should lie between 36 and 38.

Any admixture with pentane of hydrocarbons belonging to other groups and having a higher photogenic value—such as benzene or amylene—must be avoided. Their presence may be detected by the following test: Bring into a stoppered white-glass bottle, of from 80 c.c. to 100 c.c. capacity, 10 c.c. of nitric acid, specific gravity 1·32 (made by diluting pure nitric acid with half its bulk of water). Add a few drops of a dilute solution of potassium permanganate, sufficient to give to the acid a full and permanent pink colour. Pour into the bottle 50 c.c. of the sample of pentane, and shake strongly from time to time during five minutes. If no hydrocarbons other than paraffins are present, the pink colour, though somewhat paler, will still be distinct. If there is an admixture of as much as ½ per cent. of amylene or benzene, the colour will have disappeared.

APPENDIX C.

THE TABLE PHOTOMETER.

The several parts of the apparatus stand upon a well-made and firm table, 5 ft. 6 in. by 3 ft. 6 in., and 2 ft. 5 in. high. The

TABLE REFERRED TO

Aerorthometer ...		·930	·940	·950	·960	·970	·980	·990	1·000
Tabular Number...		1·075	1·064	1·053	1·042	1·031	1·020	1·010	1·000
Minute.	Seconds.								
1	44	12·90	13·03	13·17	13·31	13·45	13·59	13·73	13·87
	45	13·02	13·16	13·30	13·44	13·58	13·72	13·86	14·00
	46	13·14	13·29	13·43	13·57	13·71	13·85	13·99	14·13
	47	13·27	13·41	13·55	13·70	13·84	13·98	14·12	14·27
1	48	13·39	13·54	13·68	13·82	13·97	14·11	14·26	14·40
	49	13·52	13·66	13·81	13·95	14·10	14·24	14·39	14·53
	50	13·64	13·79	13·93	14·08	14·23	14·37	14·52	14·67
	51	13·76	13·91	14·06	14·21	14·36	14·50	14·65	14·80
1	52	13·89	14·04	14·19	14·34	14·49	14·63	14·78	14·93
	53	14·01	14·16	14·31	14·46	14·61	14·77	14·92	15·07
	54	14·14	14·29	14·44	14·59	14·74	14·90	15·05	15·20
	55	14·26	14·41	14·57	14·72	14·87	15·03	15·18	15·33
1	56	14·38	14·54	14·69	14·85	15·00	15·16	15·31	15·47
	57	14·51	14·66	14·82	14·98	15·13	15·29	15·44	15·60
	58	14·63	14·79	14·95	15·10	15·26	15·42	15·58	15·73
	59	14·76	14·91	15·07	15·23	15·39	15·55	15·71	15·87
2	0	14·88	15·04	15·20	15·36	15·52	15·68	15·84	16·00
2	1	15·00	15·17	15·33	15·49	15·65	15·81	15·97	16·13
	2	15·13	15·29	15·45	15·62	15·78	15·94	16·10	16·27
	3	15·25	15·42	15·58	15·74	15·91	16·07	16·24	16·40
	4	15·38	15·54	15·71	15·87	16·04	16·20	16·37	16·53
2	5	15·50	15·67	15·83	16·00	16·17	16·33	16·50	16·67
	6	15·62	15·79	15·96	16·13	16·30	16·46	16·63	16·80
	7	15·75	15·92	16·09	16·26	16·43	16·59	16·76	16·93
	8	15·87	16·04	16·21	16·38	16·55	16·73	16·90	17·07
2	9	16·00	16·17	16·34	16·51	16·68	16·86	17·03	17·20
	10	16·12	16·29	16·47	16·64	16·81	16·99	17·16	17·33
	11	16·24	16·42	16·59	16·77	16·94	17·12	17·29	17·47
	12	16·37	16·54	16·72	16·90	17·07	17·25	17·42	17·60

$$\text{Illuminating Power} = \frac{\text{Aerorthometer Reading} \times \text{Time in Seconds}}{7{\cdot}5} \text{ or } = \frac{\text{Time in Seconds}}{7{\cdot}5 \times \text{Tabular Number.}}$$

upper surface of this table is smooth, level, and dead black. Upon this are placed or clamped in the positions shown in fig. 3, p. 1258: (1) Gas-meter; (2) gas governor; (3) regulating tap; (4) "Sugg's London Argand, No. 1" burner; (5) connecting pipes; (6) pentane ten-candle lamp; (7) photoped; (8) aerorthometer; (9) stop clock; (10) dark screens.

(1.)—*The Gas-Meter.*

The gas-meter is sufficiently described above.

(2.)—*The Gas Governor.*

The gas governor must be such as will effectually do away with any variation of pressure produced by the working of the meter or other causes.

(3.)—*The Regulating Tap.*

This must have a large well-fitting barrel, with a round hole on each side, of such a size as to allow gas to pass at the rate of about 4 cubic feet per hour under the pressure at the outlet of the governor. In addition, there must be narrow saw-cuts on opposite sides of the two holes when viewed in plan, which will allow an additional passage of about 2 cubic feet of gas per hour when the tap is so turned that the holes and the saw-cuts are both opposite the orifices of the fixed part of the tap. The construction of the tap is shown in fig. 4. The index must be secured to the barrel without any play; and its pointed end must pass over a scale graduated in degrees upon an arc of not less than 80 mm. radius. The arc is to extend over 92°, and the degrees are to be numbered from 0° to 90°. The arc is to be made of white enamel glass; and the divisions are to be etched upon it, and the marks filled in with black. The tap is to be off when the pointer is at one extremity of the arc at 0°, and fully on when it is at the other extremity at 90°. The small hole should be fully open at about 20°, so that the action of the saw-cuts may extend over the remaining portion of the arc. The tap must be kept clean and sufficiently lubricated to work easily.

(4.)—*The "Sugg's London Argand, No. 1" Burner.*

This is the burner described in Appendix D. It is to be mounted upon a tripod with flat projecting feet, so that its position upon the table can be adjusted at any time. It may be clamped in position by three ⌐ shaped clamps, each made to pinch upon one foot by the action of a single carpenter's screw. The construction of the foot and clamp is shown in fig. 5. The height of the top of the steatite burner is 353 mm. above the

IN APPENDIX E (p. 1259).

1·010 ·990	1·020 ·980	1·030 ·971	1·040 ·962	1·050 ·953	1·060 ·944	1·070 ·935	1·080 ·926	1·090 ·918	1·100 ·909	1·110 ·901	1·120 ·893
14·01	14·14	14·28	14·42	14·56	14·70	14·84	14·98	15·11	15·25	15·39	15·53
14·14	14·28	14·42	14·56	14·70	14·84	14·98	15·12	15·26	15·40	15·54	15·68
41·27	14·42	14·56	14·70	14·84	14·98	15·12	15·26	15·41	15·55	15·69	15·83
14·41	14·55	14·69	14·84	14·98	15·12	15·27	15·41	15·55	15·69	15·84	15·98
14·54	14·69	14·83	14·98	15·12	15·26	15·41	15·55	15·70	15·84	15·98	16·13
14·68	14·82	14·97	15·11	15·26	15·41	15·55	15·70	15·84	15·99	16·13	16·28
14·81	14·96	15·11	15·25	15·40	15·55	15·69	15·84	15·99	16·13	16·28	16·43
14·95	15·10	15·24	15·39	15·54	15·69	15·84	15·98	16·13	16·28	16·43	16·58
15·08	15·23	15·38	15·53	15·68	15·83	15·98	16·13	16·28	16·43	16·58	16·73
15·22	15·37	15·52	15·67	15·82	15·97	16·12	16·27	16·42	16·57	16·72	16·87
15·35	15·50	15·66	15·81	15·96	16·11	16·26	16·42	16·57	16·72	16·87	17·02
15·49	15·64	15·79	15·95	16·10	16·25	16·41	16·56	16·71	16·87	17·02	17·17
15·62	15·78	15·93	16·09	16·24	16·39	16·55	16·70	16·86	17·01	17·17	17·32
15·76	15·91	16·07	16·22	16·38	16·54	16·69	16·85	17·00	17·16	17·32	17·47
15·89	16·05	16·21	16·36	16·52	16·68	16·83	16·99	17·15	17·31	17·46	17·62
16·03	16·18	16·34	16·50	16·66	16·82	16·98	17·14	17·29	17·45	17·61	17·77
16·16	16·32	16·48	16·64	16·80	16·96	17·12	17·28	17·44	17·60	17·76	17·92
16·29	16·46	16·62	16·78	16·94	17·10	17·26	17·42	17·59	17·75	17·91	18·07
16·43	16·59	16·75	16·92	17·08	17·24	17·41	17·57	17·73	17·89	18·05	18·22
16·56	16·73	16·89	17·06	17·22	17·38	17·55	17·71	17·88	18·04	18·20	18·37
16·70	16·86	17·03	17·19	17·36	17·53	17·69	17·86	18·02	18·19	18·35	18·52
16·83	17·00	17·17	17·33	17·50	17·67	17·83	18·00	18·17	18·33	18·50	18·67
16·97	17·14	17·30	17·47	17·64	17·81	17·98	18·14	18·31	18·48	18·65	18·82
17·10	17·27	17·44	17·61	17·78	17·95	18·12	18·29	18·46	18·63	18·80	18·97
17·24	17·41	17·58	17·75	17·92	18·09	18·26	18·43	18·60	18·77	18·94	19·11
17·37	17·54	17·72	17·89	18·06	18·23	18·40	18·58	18·75	18·92	19·09	19·26
17·51	17·68	17·85	18·03	18·20	18·37	18·55	18·72	18·89	19·07	19·24	19·41
17·64	17·82	17·99	18·17	18·34	18·51	18·69	18·86	19·04	19·21	19·39	19·56
17·78	17·95	18·13	18·30	18·48	18·66	18·83	19·01	19·18	19·36	19·54	19·71

$$\text{Illuminating Power} = \frac{\text{Aerorthometer Reading} \times \text{Time in Seconds}}{7{\cdot}5} \text{ or } = \frac{\text{Time in Seconds}}{7{\cdot}5 \times \text{Tabular Number.}}$$

table. The axis of the burner should be vertical. If it is found to lean in any direction, paper or card should be inserted under one or more of the feet until it is found to be vertical after being clamped in position.

(5.)—*The Connecting Pipes.*

These are to be made of ½-inch (outside measure) composition piping. They are to be connected with the different pieces of apparatus by ⅜-inch unions, except in the case of the gas-meters, where the unions belonging to the meter may be retained. In all cases the boss of the union is to be attached to the apparatus, and the cap and lining to the ends of the connecting pipe. These pipes are to be placed above the table. No grooves, recesses, or holes, other than the screw holes for the screws referred to in this appendix, are to be made in the table.

(6.)—*The Pentane Ten-Candle Lamp.*

This is described in Appendix A. The lamp need only be placed in position upon the table; but for permanent use clamps corresponding to those used to secure the feet of the "London" argand should be employed. The height of the top of the steatite burner is 353 mm. above the table. The construction of the screw, swivel plate, and clamp is shown in fig. 6.

(7.)—*The Photoped.*

The photoped is represented in fig. 5. It consists of the following parts: A plate, 100 mm. square, with a central hole, 21 mm. square. This is held in a vertical position by an upright support, so that the centre of the square is 400 mm. above the table. The upright is carried by a tripod similar to that used for the "London" argand, and secured in the same way to the table. To one face of the square plate is fastened, by two binding screws, a clamping plate, 60 mm. × 40 mm., also with a central hole, 21 mm. square, so that the two openings are opposite one another. A piece of suitable white paper is pinched between the two plates, so as to cover the openings and project a little way below the clamping plate. The clamping plate carries centrally a horizontal tube about 35 mm. in diameter and 30 mm. in length. In this slides smoothly a smaller tube, containing a diaphragm in which a rectangular slit, 25 mm. × 7 mm., has been cut. To the upper surface of the larger brass plate, and on the same side as the clamping plate, is fixed a strip of glass; so that the lower edge is close to, and exactly parallel to, the plate, while the upper edge is so much in advance as will allow the reflection to the flame [described later on] to be observed. The photoped should be plumbed vertical. If it

is found to lean sensibly towards or away from the lamps, paper or card should be inserted under one or more of the feet until it is found to be vertical after being clamped in position.

(8.)—*The Aerorthometer.*

This is, in effect, an air thermometer and a barometer combined—consisting of a bulb and vertical stem in which sufficient water is present to ensure that the air is saturated. The measuring tube, which terminates in a closed bulb, and a companion tube which is open to the air, dip into a reservoir of mercury in

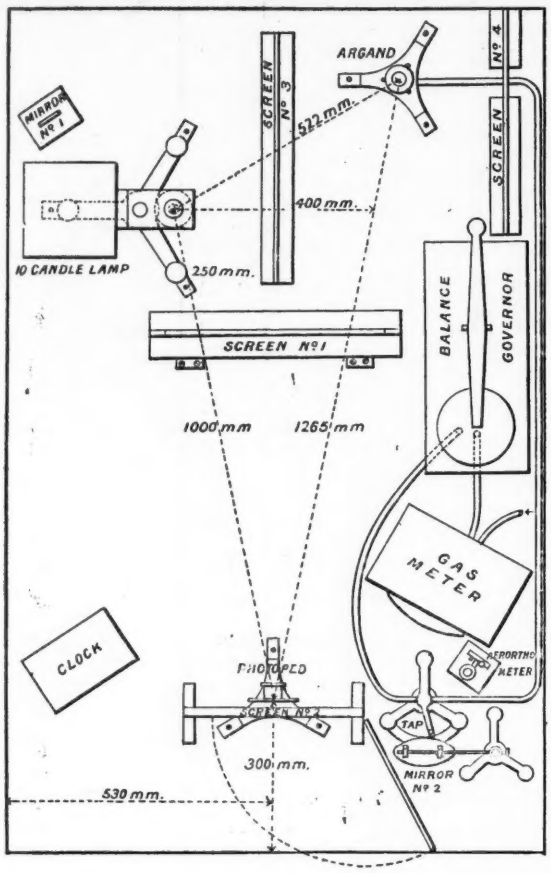


FIG. 3.

the base, the capacity of which can be adjusted by a regulating-screw pressing on a leather cover. The relative volume of the bulb and tube down to any division is represented by the number belonging to that division. In using the aerorthometer, turn the screw up until the level of the mercury in the open tube is below that of the mercury in the bulb tube. Then turn the screw slowly down until the mercury stands at the same level in both tubes. The division at which the mercury now stands

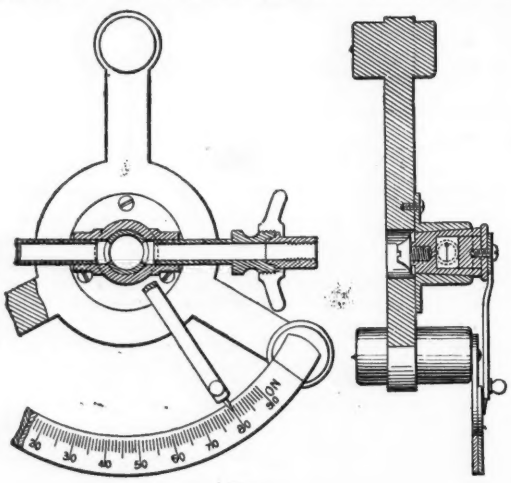


FIG. 4.

is the aerorthometer reading. The Gas Examiner shall, not less often than once a month, compare the aerorthometer reading with the reciprocal of the tabular number deduced from observations of the barometer and thermometer; and if there is a difference of more than 0·5 per cent. the instruments are to be readjusted.

(9.)—*The Stop-Clock.*

This is the clock ordinarily used in testing-places, either attached to the meter or independent of it. It must be provided with mechanism for starting and stopping.

(10)—*Dark Screens; Mirrors.*

Five dark screens are provided, in order to prevent the inaccuracy and inconvenience to which stray light would give rise. The first is placed between the burners and the photoped, in the position shown in fig. 3. This screen is 500 mm. square, with two rectangular openings. The opening to the left is 40 mm. wide and 55 mm. high, and its lower edge is 350 mm. above the table. The opening to the right is 50 mm. wide; its lower edge is 340 mm. above the table; and it extends to the top of the screen. The centre lines of these two openings are 300 mm. apart. The screen is carried by a wooden foot about 500 mm. by 100 mm. and 30 mm. thick. Care must be taken

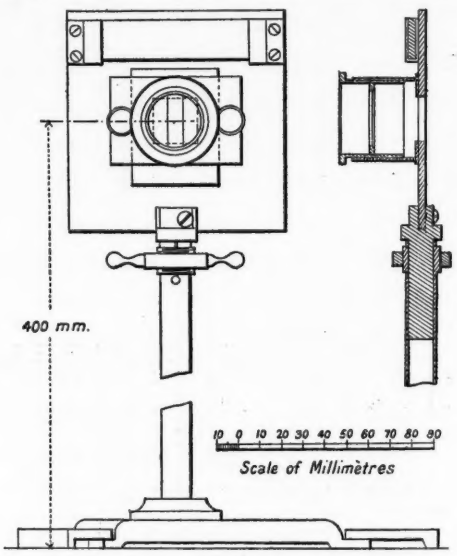


FIG. 5.

that it is so adjusted that the whole of the flame under the tube C of the 10-candle lamp, and the whole of the chimney and burner of the argand can be seen through all parts of the slit of the photoped when the paper is removed for that purpose. The foot may then be fastened to the table by means of two hinges, so that the screen may be folded down when the position of the lamp is being verified and may be easily replaced. The second dark screen consists of a piece of black velvet or black cloth 350 mm. square stretched on a frame and supported so that its lower edge is 150 mm. above the table. In this is cut a hole 50 mm. square with its lower edge 380 mm. above the table. This screen is placed close to the photoped, but on the opposite side to that facing the lamps, and with the square hole opposite the square hole in the plate of the photoped. To the right side of the frame is hinged a light frame 450 mm. high and 300 mm. wide. On this also is stretched black velvet or black cloth. This prevents the illuminated dial of the meter or arc of the regulating tap from interfering with the photometric observations; while at the same time it can be readily moved when these are to be

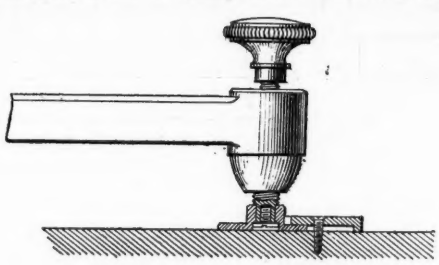


FIG. 6.

observed. The third dark screen is about 500 mm. long and 750 mm. high. The fourth is about 450 mm. long and 750 mm. high. These may be made of card painted dead black, or of thin wood, and may be placed approximately in the positions shown in fig. 3. The fifth screen consists of a piece of black velvet or cloth, large enough to form a black background to the lamps when viewed from the photoped. It is best placed upon the wall; but if that is inconvenient or other objects intervene, it should be supported on a stand, but always so as to be at least 300 mm. behind the flames of the lamps.

Two small mirrors are carried on light stands. One of these (made of ordinary flat silvered glass) is vertical, and is so placed as to enable the Gas Examiner, when seated at the photoped

end of the table, on moving his head to the left of the second dark screen, to see by reflection the tip of the flame of the ten-candle lamp through the mica window in the tube C. The other, which should be about 120 mm. in diameter, is convex, and should have a radius of curvature of about 400 mm. It is placed on the observer's right, and is so inclined that it casts a diverging beam of subdued light upon the divided arc of the regulating tap, upon the face of the meter, upon the aerorthometer, and upon the Gas Examiner's note book.

All the apparatus on the table upon which light can fall, and which might by reflection illuminate the photoped, or catch the eye of the operator, is to be painted dead black, or, if of finished brass, bronzed before being lacquered.

The correct position of the photoped and of the two burners is to be verified as follows: Each burner is provided with a measuring rod, securely fastened transversely to a cylindrical and shouldered plug which just fits into the steatite ring and rests upon it. The rod belonging to the 10-candle lamp is to be 1·000 metre from the axis of the plug to the extreme point. The rod belonging to the "London" argand is to be 1·265 metres from the axis of the plug to the extreme point. Each rod is to be balanced about the plug. Each must be capable of being placed in its burner without disarranging the burner, except in the removal of the glass chimney of the "London" argand or the conical shade of the 10-candle lamp. Each rod should terminate in a rounded ivory point. When these rods are placed in their burners, and the long ends are moved gradually round towards the photoped, they should just come in contact with the paper under the clamping plate at the middle point.

A third rod is provided with two plugs one to fit each burner, and with their centres exactly 0·522 metre apart. The two plugs should just drop into the steatite rings of the two burners. If any one of these tests shows the burners to be incorrectly placed, their position is to be altered until all the measurements are correct. After this process, the burners are to be lighted, the flames turned low, and the reflection of one is to be observed over the other on the glass of the photoped. If the reflection appears central, the photoped is symmetrically placed with respect to the two burners; if not, the nut on the standard is to be loosened, and the plate turned until the reflection is central. The two lights are then to be turned up, and the slit is to be moved (in or out) until the two rectangular spaces illuminated by the two lights just meet but do not overlap.

Appendix E.

This is a table (see pp. 1256-7) giving the illuminating power of gas from observations of the rate of consumption required to yield the light of 16 candles, and from readings of the barometer, thermometer, and Referees' tables, or of the aerorthometer. The observed time of passage through the meter of one-sixth of a cubic foot of gas is to be found in the left-hand column; and the aerorthometer reading or tabular number in the top lines. In the corresponding line and column is found the illuminating power.

Appendix F.

This is the now well-known table "to facilitate the correction of the volume of gas at different temperatures and under different atmospheric pressures." It is unnecessary to reproduce the table as it has been given in the various editions of "Newbigging's Gas Managers' Hand Book" and most other text-books dealing with gas subjects.

Appendix G.

Test for Sulphuretted Hydrogen.

The apparatus represented by fig. 7 consists of a plate with a circular channel half filled with mercury, upon which rests a

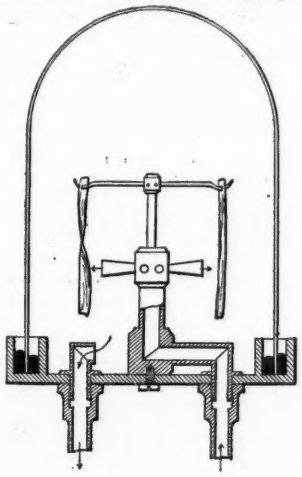


Fig. 7.

bell-glass. A central standard connected below with the gas-inlet carries six lateral branches of the form shown, through which the gas issues into the bell-glass, and above each of these a wire, pointed and curved at the end, from which a slip of lead-paper hangs immediately in front of the narrow opening through which the gas issues. A second pipe passing through the plate and terminating above in a short elbow provides an outlet for the gas. After the apparatus has been furnished with fresh slips of lead-paper and the bell-glass has been replaced, it is to be covered with a shade to exclude light.

Appendix H.

This describes the well-known sulphur-test apparatus with the trumpet tube over the gas flame and glass cylinder filled with "balls of glass;" and, like Appendices F and K, it needs no further notice.

Appendix K.

This is an illustrated description of the Gas Referees' Street-Lamp Pressure-Gauge, without modification from the form in which it has hitherto been known.

Appendix L.

The Gas Referees' One-Twelth of a Cubic Foot Measure.

This instrument is represented in fig. 8. It consists of a vessel of blown glass, of a cylindrical form, with rounded ends terminating in short tubes about 40 mm. in diameter outside, which tubes are reduced at their outer ends to about 20 mm. in diameter outside. Lines are etched round each tubular neck, in such positions that the capacity of that portion of the vessel included between these marks is exactly one-twelfth of a cubic foot when the glass is at the ordinary temperature. No correction is needed for the cubical expansion of the glass. The two tubular necks of the instrument pass through two boards placed

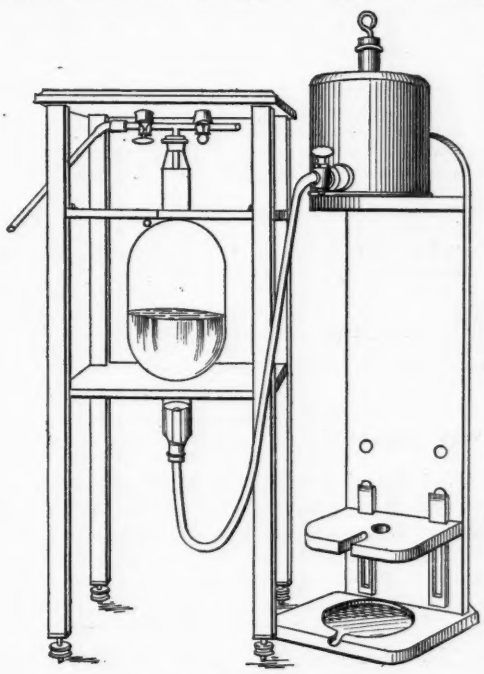


Fig. 8.

below, and parallel to, the top of a small four-legged table. For convenience, the upper one of these two boards is made in two parts and hinged to the legs.

Into each end of the instrument a glass tube about 8 mm. in diameter outside is fitted gas and water tight by means of india-rubber corks, in such positions that the inner end of the upper tube lies exactly in the plane of the mark at its end of the instrument, while that of the lower is about 1 mm. below the mark. The upper tube terminates in a T, each branch of which is provided with a stop-cock.

A separate stand carries two shelves, the upper one about 40 mm. below the level of the upper mark and the lower one below the level of the lower mark. The lower shelf is adjustable, and must be so placed that the action about to be described shall take place.

A water vessel is provided, having a capacity of about one-tenth of a cubic foot. It should be made of brass or copper, tinned on the inside. It has a tubulure near the bottom, to which is fitted a metal tap. The end of the tap is to be turned slightly downwards, and is to have a diameter outside of about 8 mm. The size of the way through the tap and of the connections is such that when a meter is being proved in the manner to be described, the water fills the instrument, from one mark to the other, in about one minute. The water vessel has a tubulure in the cover, to which a narrow glass tube is fitted by means of a cork, so that air may enter or escape. The end of the tube is bent round upon itself in the form of a crook, so as to exclude dust and dirt. An india-rubber tube connects the tube at the base of the measure with the stopcock of the water vessel. An ordinary chemical thermometer is provided for taking the temperature of the water.

The pipe supplying gas to each meter is provided near the meter with a three-way stop-cock carrying a short branch pipe, so formed that it either connects the gas supply only with the branch pipe, the meter only with the branch pipe, or the gas supply with the meter, in which latter case the branch pipe is cut off from both. The index of the tap shows which communication is open. In order to avoid sending the gas used in proving the sulphur meter through the sulphuretted hydrogen and ammonia apparatus, a separate gas supply is provided. The branch pipe is so shaped as to be convenient for the attachment of an india-rubber tube.

In order to put the instrument in adjustment, the water vessel is placed upon the upper shelf, and water is poured into it until it rises about ¼ inch in the upper narrow tube. One branch of the glass T is then connected by an india-rubber pipe with the branch of the three-way stop-cock. This is now turned so as to connect the branch pipe with the gas supply, and the water vessel is placed on the lower shelf. The water will run back into the vessel. The flow should cease when the water has just begun to descend in the lower tube. If not, the height of the lower shelf must be adjusted until this is the case.

The space above the upper mark is always filled with gas, and that below the lower mark with water, so that the capacity of these portions of the instrument has no effect upon the measurements. The narrow tubes are so small that a variation of even 1 inch in the level at which the water stands in them has no appreciable effect upon the meter reading.

The apparatus shall only be used in proving a meter when the temperature of the meter and of the water in the water vessel have been found not to differ by more than 2° Fahr.

In order to prove the meters used in the various testings, the position of the index is taken when the instrument has been put in adjustment and filled with gas as described. The tap of the water vessel is turned off, and the pressure of the gas in the instrument reduced to atmospheric pressure by momentarily opening the tap in the free branch in the glass T. The water vessel is placed upon the upper shelf, its tap turned on, and one-twelfth of a cubic foot of gas is discharged through the meter. Fig. 8 represents this operation in progress. The three-way stop-cock is then turned so as to fill the instrument with gas, which is reduced to atmospheric pressure as before; and a second, and again a third, quantity is discharged through the meter. Should the hand attached to the axle of the measuring drum have travelled in the three revolutions as much as one division beyond the point from which it started, some water must be removed from the meter. If the travel of the meter-hand is as much as one division short of this point, some water must be poured in. The operation is then to be repeated until the error is found to fall within the specified limits.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Third Annual General Meeting of the Association was held last week at Southampton; and very successful it proved. The members were present in good number; and the programme, both in its technical and convivial arrangements, was an excellent one—the only cause of regret being that the brilliant weather with which the week opened was not maintained. The business meeting commenced on Tuesday morning at the Hartley College, which had been kindly placed at the service of the Association by the Council of the Institution. The Council of the Association were first received in an anteroom by the Mayor of Southampton (Alderman G. J. Tilling); and among others introduced to his Worship by Mr. William Matthews, the Borough Water Engineer, was Mr. R. Richards, the Mayor and Chairman of the Water Committee of Wigan, who had been deputed by his colleagues to attend the conference. In the meantime, the members had assembled in the spacious lecture hall, where, within a few minutes of the appointed hour, Mr. H. Ashton Hill, the retiring President, took the chair, having on his right and left the Mayor and other prominent local gentlemen.

The Mayor at once rose, and, in the name of the citizens of Southampton, offered the members a cordial welcome. He also remarked that the borough was particularly fortunate in having a good and sufficient water supply; and the ratepayers could congratulate themselves upon having had the works carried out most effectively, at a moderate cost, under the superintendence of their Engineer (Mr. W. Matthews), whom the Association had honoured by electing as President for the coming year.

On the motion of Mr. Hill, seconded by Mr. D. M. F. Gaskin (Liverpool), the members acknowledged by acclamation the cordial reception that had been extended to them by the Mayor and Corporation.

Confirmation of Minutes.

The Secretary (Mr. W. H. Brothers) read the minutes of the meeting held in London in February; and they were confirmed.

Election of Office-Bearers and Members.

Mr. C. Sainty (Windsor) and Mr. W. Millhouse (Scarborough) were appointed Scrutineers of the ballot for officers and members. While the examination of the papers was proceeding,

Mr. Gaskin gave notice that at the next meeting he should move that Rules 30 and 31 be amended, in order that the President for the incoming year might be elected at the February meeting, instead of at the meeting at which he had to take the chair for the first time and read his Inaugural Address. On some future occasion the Association might, under the present procedure, be placed in an awkward position if the gentleman nominated was not elected.

Mr. Matthews thought it would be better not to divide the election of officers; and therefore he suggested that the notice of motion should cover them all.

Mr. Gaskin intimated that he was quite willing to extend the notice.

Subsequently the Scrutineers reported that the following had been elected to take office:—

President.—Mr. William Matthews, of Southampton.

Vice-Presidents.—Mr. W. Watts, of Sheffield; and Mr. C. H. Priestley, of Cardiff.

Council.—Messrs. F. Griffith, C. E. Jones, W. B. Leggatt, W. A. Richardson, Hamlet Roberts, E. Sandeman, R. H. Swindlehurst, W. Terrey, E. A. B. Woodward, and J. A. Paskin.

Hon. Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

The following were admitted as members and associates:—

Members.—W. A. Palliser, of Featherstone; J. M. Mackenzie, of Chile; C. Mamede, of Pernambuco; W. H. Scholes, of Buenos Ayres; T. W. A. Hayward, of Sudbury; H. Riley, of Gainsborough; T. Hughes, of Leighton Buzzard; W. Eggie, of Brechin; J. C. Amos, South Hants Water-Works; and Dr. Thresh.

Associates.—Class A: E. Berrington, of Wolverhampton; H. Robinson, of Bishop Auckland; and W. F. Sutton, of Birmingham. Class B: W. H. Prescott, of Reigate; A. G. Cloake, of London; and F. G. Ham, of Westminster.

Mr. Oscar J. Kirby, of Batley, and Mr. F. J. Bancroft, of Hull, were appointed Auditors for the year.

Annual Accounts.

The Secretary read the revenue account and balance-sheet for 1897, which showed a balance forward of £185, after providing for all liabilities. The membership now numbers 195.

The Water Board Committee.

The President said the next matter for consideration was the re-election or otherwise of the Committee on Water Boards. He might say that being a member of the Committee had been an advantage to him, as it had drawn his attention forcibly to the series of questions involved in the matter. To his mind, there was no doubt that the time was ripe for fresh legislation in connection with water supply, and particularly as to the purification of rivers. He thought it desirable that the Association should keep in touch with the question. The Committee who were appointed last year came to the conclusion that they could not take any aggressive steps; and the resolution they arrived at was to the effect that the Association could only act, and would be prepared to do so, in conjunction with some other body or bodies, with the view of initiating fresh legislation.

Mr. Gaskin moved the re-appointment of the Committee; and he did so because he thought it well the Association should keep a watchful eye on all matters relating to this question. It was certainly time that there was fresh legislation in the matter of water supply. Only last year he was consulted in regard to the supply of a district in Huntingdonshire; and there he found wells and cesspools in close proximity, and the same depth. The wells were unlined, and only 18 feet deep.

Mr. F. J. Bancroft (Hull) seconded the motion. He suggested that the Committee should give the members a *résume* of their deliberations, in order that they might know the points that had been considered. In this way matters which came to the personal knowledge of members that had not been touched upon might be brought to the attention of the Committee; and this would give them an opportunity of acting in unison, and so strengthen the Committee.

The motion was carried; and the Secretary was instructed to note the suggestion as to the issue of the reports of the deliberations of the Committee to members.

Dr. Kemna (Antwerp) thought the re-appointment of the Committee was the right course to adopt. It seemed to him that at the present time those who had the framing of legislation and rules to govern the supply of water had not the necessary competence; and therefore, if the Association were able to secure the amendment of legislation, it would be a great boon not only to this country, but to the whole of the civilized world, seeing that England had started the pure-water question. He compared the conditions of water supply in this country and on the Continent, and showed the difficulty they had abroad in suppressing waste and misuse, especially if the suppliers were an English Company. In his opinion, the programme of the Committee should be extended, so that they could make inquiries on other points than those which were now receiving their attention, and then, in course of time, they might frame a Bill for presentation to Parliament which would give a fair representation to all the interests concerned.

Mr. Gaskin remarked that Dr. Kemna must remember that the Association was very young, and had not attained to the position of such a body as the Institution of Civil Engineers, who really ought to take up this matter.

Mr. HILL observed that Dr. Kemna had a pretty clear conception of the interests which were involved in the matter; but he did not know all that was going on in this country. The County Councils' Association possessed much larger powers than any other body; and they were going into this question. As a matter of fact, they were framing a Bill; and it seemed to him they would be more likely to advance legislation than their own Association. However, when the Bill was promoted, the Association would endeavour to have a voice in the matter.

THE NEW PRESIDENT.

Mr. HILL said the time had arrived for him to vacate the chair, and ask their newly-elected President to take it. He hoped when Mr. Matthews reached the end of his term of office, he would leave it with as few regrets as he (Mr. Hill) did that morning. He trusted the members would extend to their new President the support and kindness he had himself experienced during the past year.

The PRESIDENT, on taking the chair, was greeted with much applause. He said he fully appreciated the honour the members had done him by electing him to be their President; and he assured them that nothing should be wanting on his part during the next twelve months to further the best interests of the Association. They knew that he had taken sufficient interest in the Association not to have missed any of the meetings, and had been from the first a member of the Council. He had always been desirous that they should progress in the right way —not too fast, but at the same time looking to an increase of numbers as being desirable. The policy that the Council had adopted in the past had had his hearty support; and it seemed to have met with the approval of the members. He hoped they would go on and do as well as they had done in the past.

VOTE OF THANKS TO THE EX-PRESIDENT.

Mr. W. A. RICHARDSON (Birkenhead) moved that the hearty thanks of the members be accorded to Mr. H. Ashton Hill for the manner in which he had conducted the work of the Association during the past year.

Mr. GASKIN, in seconding the motion, remarked that Mr. Hill had interested himself so much in the work of the Association since its inception, and to such a large extent during the past year, that they were very proud indeed of it that day. In Mr. Matthews they had a President who would follow well in his predecessor's footsteps.

The motion, which was supported by Mr. PEIRCE and the PRESIDENT, was heartily agreed to.

Mr. HILL, in reply, said he felt very fully the kind words that had been used by those who had spoken to the motion. It was a difficult thing to speak about oneself; and he would sooner let his work speak for him. He could truly say that he had taken a very great interest in the Association. He had never liked to be connected with anything that was not a success; and he had striven hard, with the assistance of the Council and members, to secure success. It was a great satisfaction to him that his work had received hearty recognition of the members.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, from which we have extracted the following:—

The address was mainly an exposition of the position, responsibility, and duties of a water-works engineer and manager; and, in the opening lines, the President said it is only within recent years that the water-works engineer has had a separate professional existence. But, combined with other cognate offices, he has from an early date left his indelible mark behind him in the shape of works which have had an important influence upon civilization. The present century has seen public supplies introduced into every large town, as well as to many villages and rural districts; and considering the enormous value of the works furnishing these supplies, as well from the hygienic as the financial point of view, it becomes obvious that the position of those who have the designing and management of such undertakings is one of the gravest responsibility. In the past it has not been uncommon to combine with other offices the management of water-works, engaging at times the services of engineers of greater or less eminence to design new works or advise in special cases. In this way it has happened that surveyors, gas managers, engine-drivers, fitters, clerks, and others have undertaken the duties of water-works managers in a very large number of cases without possessing any proper qualification fitting them for such a post; and it is largely due to this indiscriminate mixing up of duties that the water supplies of a number of towns have drifted into an unsatisfactory condition. Pursuing this point, the President remarked: If the water supply to any considerable community is to receive from its responsible manager the attention it should do, then I ask you to consider seriously whether it be possible for such a man to do his duty except by giving his undivided time and attention to this one subject, and by being regularly trained in those special matters which appertain to hydraulic engineering as applied to water supply. Take the case of combined gas and water works companies, in practically every instance the engineer or manager has had his training in the line of gas supply; and it is a notorious fact that, with few exceptions, such undertakings are, as regards the water supply, scandalously badly managed or, perhaps, more properly speaking, neglected. The water engineer and manager must, if fully alive to the greatness of his responsibility, be ever on the alert, and prepared to cope with all the inevitable difficulties and accidents attending the working and maintenance of complex systems, extending over great lengths, and involving the use of structures, machinery, fittings, and appliances, all of which are liable to failure through natural decay, unusual strain, or accident.

The President next commented upon the value of the large mass of information that has been gathered together on the subject of water supply by the water engineers of the past; and he maintained that water engineers of the present day are also bound to be continually observing and recording for the benefit of their successors. He hesitated to think that governing bodies, as a rule, would decline to aid in such work, both by encouraging their officers and providing the necessary means for keeping up and extending the records of facts and phenomena which are, or possibly may be, of value in connection with questions of water supply. They may welcome such information and reap its benefits in their own day and generation, for all they know to the contrary. He asserted confidently that already large sums of money have been wasted on works which, in the light of the results of systematic observation of the conditions and environments of certain water supplies, would never have been constructed at all, or only in much modified form.

Coming to the actual work which may be required of water engineers, the President said: The design and construction of works occupies the first position; and it seems desirable to warn those of limited experience to combat the natural temptation of undertaking too much responsibility in propounding schemes whose soundness has not been tested by the reports thereon of independent engineers or other experts. There is no greater sign of weakness than to object to such a course. A confirmation of suggested plans at once places an official in a strong position, and future hostility on the part of an opposition is heavily discounted; while, on the other hand, should such proposals be proved faulty, his employers will be saved from useless vexation, waste of money, and possible failure, alike disastrous to them and to the official's reputation. The expenditure of large sums on public works must ever be the subject of serious consideration at the hands of governing bodies; and we have no right to expect that they shall commit themselves to any scheme of ours without giving it the fullest consideration, and until it has been critically, but fairly, discussed and its need established. The fear of hostility to a proposal to spend money should never deter an engineer or manager from advocating strongly and persistently the execution of works or measures which he is convinced are necessary for the well-being of the undertaking he is connected with. The knowledge he possesses of the needs of the case is not his to keep, but is paid for by those who employ him; and theirs is the responsibility of deciding whether or not to adopt his reports.

Then, again, works may, with equally false judgment and skill, be designed either too large or too small; and it is not always easy to arrive at the happy medium, so that, while the demand upon the supply shall not too quickly outgrow its capabilities, there shall not be an unnecessarily large amount of capital expended which must or may remain for a long time unremunerative. Judgment must be exercised in making due provision for future extensions, and matters must be so arranged that these can at any time be carried out conveniently without disturbance of the regular supply of water, and so as to render possible the economical working of the whole system both before and after extension. Work of a more or less temporary character may, under exceptional circumstances, be permissible; but as a rule everything in the way of works or plant upon which the supply of water to large numbers of people depends should be of the most permanent and thoroughly good character, avoiding all showy and useless decoration, which is costly and often so out of place as to be actually grotesque. "*Ars longa, vita brevis*," is an old Latin adage, and may be aptly applied to the life of poor engines placed in highly decorated houses, but on indifferent foundations.

Dealing with a question of prime importance—viz., the selection of the site for works, the President said it frequently necessitates an appeal to the advice of the geologist; but it is also incumbent upon the engineer to collect and deduce proper conclusions from information relating to the rainfall, run-off, evaporation, subterranean water-levels, and the general conditions prevailing around the proposed works. The question of accessibility may be temporarily of importance as regards the transport of materials for construction, or permanently if coal has to be used for pumping. Speaking of the increasing amount of attention which is, and must be, given to the subject of the liability to pollution of the sources of supply and in selecting sites for works, he referred to the paper lately read before the Society of Engineers by Dr. Thresh, and suggested that it should be studied by all who are interested in water supplies.

On the important question of designing works, the President spoke as follows: Future economy in the method of working and maintaining the works in a state of efficiency must be kept steadily in view; and, where machinery is to be used, its character must be determined with care. The pumping plant in use in this country is probably necessitating the consumption of at least double the quantity of coal really necessary for the work owing to the use of an immense number of engines and

pumps of unsuitable and badly designed types. At the present value of money, the saving of £100 per annum in coal justifies the expenditure of £2000 upon new or improvement to old machinery—a fact which ought to be kept clearly in mind. To be in a position to grapple with this question, the engineer must know with certainty what work, for a given expenditure, his plant is doing, not only when first put down, but afterwards and when in daily use. He must, therefore, make regular tests, assuming nothing, taking nothing for granted, but arriving at a conclusion from facts. To one particular point I would draw special attention, on account of its importance as bearing upon the whole question of the available supply for any town where pumping is resorted to, or the water is not measured before delivery into the distributing-mains. The quantity delivered is too often estimated from the displacement of pumps, whose slip is not accurately known, and is a quantity varying with the condition of the working parts, which may not have been examined for a long period. Then, again, in the absence of counters or recording gear, an estimate is also made of the number of strokes made during working hours, assuming a fixed normal speed per minute of the engines. Could anything be more unsatisfactory? From these hypotheses, the daily consumption per head is worked out, and people are horrified at the apparent extravagant habits of the water consumer, or the mains and fittings are condemned as leaky, whereas the fault is in the pump, which is probably not lifting anything like the quantity represented; and the engine—in truth a very fire-eater—has the specious credit of being economical in steam consumption. Pumps should therefore be well looked after, and means taken to measure the water lifted by them; otherwise there may arise a seeming necessity for additional plant which is, in fact, quite unwarranted.

These considerations lead the President to point out the duty which devolves upon the engineer or manager in connection with the detection of waste or leakage. He must not incur waste of money and time in hunting for what does not exist; and where the total consumption appears too high, the actual discharge of pumps, and the leakage from reservoirs and other receptacles for water, must be first tested. Then he may well adopt a regular system whereby the location of leaky pipes and fittings can be fixed and subsequently repaired. He must, however, use judgment as to how far such a system shall be carried, and the relation between the cost of water wasted and of working the detecting system must be carefully weighed.

Some useful observations followed regarding the necessity of great care being given to the distribution system. The immediate needs of the case must not alone be considered, but judgment exercised and provision made for extensions and future development of growing districts. Additional mains must not be laid so as to create complex systems which are a complete puzzle to the turncocks, and may give rise to serious complications in time of fires or accidents. In busy towns, the streets are becoming so crowded with pipes and conduits of all sorts, that it is necessary to reduce their number to the smallest conformable with giving a satisfactory supply through them; and it must be borne in mind that the single pipe conveying any given volume of water occupies less space than a pair or more giving only the same aggregate discharge.

Proceeding to the subject of house-fittings, the President said it is always difficult to deal with on account of the rooted hostility of the jerry-builder and tinkering plumber to use any but the cheapest and worst fittings procurable. Their opposition must be met. It is, he emphatically remarked, intolerable that the great body of consumers should be called upon to pay for the water wasted through fittings not their own, and over which they have no control; and the engineer or manager must see to this, and exercise the very considerable power he has at his disposal to punish the evil-doer. The meter question is also still a difficult one; and care has to be exercised that only those are allowed to be used which, owing to the character of the water, will not readily cease to register accurately, or by undue wear cause great expense for repair.

The management of workmen, the organization of the office, the responsibility of the engineer in preparing for parliamentary proceedings, and the personal and official relationship of the engineer and manager to his employers and to the general public, were further points to engage attention—the interesting address concluding with these words: Such are some of the manifold duties of the offices we fill. Perfection is here unattainable; and, erring in judgment, at times we shall fail—those only who have done nothing making no mistakes. To satisfy everybody is equally unattainable. But we can and must follow fearlessly in those paths which we feel and know to be right; and however much we may be misunderstood for the moment, reliance must be placed on the future to show that we have, in spite of all obstacles, done our duty to our profession and to those who honour us with their confidence.

On the proposition of Mr. HILL, seconded by Mr. WATTS, the President was heartily thanked for his address.

PAPERS AND DISCUSSIONS.

During the afternoon of Tuesday and the mornings of Wednesday and Thursday, papers were read and discussed as follows: (1) "Extension of Filter-Beds, &c., Service Reservoir, and Water Tower at Cardiff," by Mr. C. H. PRIESTLEY, of Cardiff. (2) "The Sources of Town Water Supplies, and their Bearings upon the Public Health," by Mr. R E. W. BERRINGTON, of Wolverhampton. (3) "Gosport Water Supply," by Mr. E. T. HILDRED, of Southampton. (4) "The Chemical and Bacterial Examination of Water," by Dr. PERCY F. FRANKLAND.

[The papers and discussions will be dealt with in future issues.]

A VOTE OF THANKS.

At the conclusion of the proceedings on Thursday morning, a hearty vote of thanks was passed to the Town Council and the Council of Hartley College for the facilities they had kindly given to the Association for the meeting.

SOCIAL FUNCTIONS AND EXCURSIONS.

At the close of the morning sitting on Tuesday, the Mayor entertained a large company at luncheon to meet the President and members of the Association. The repast was a liberal one; and it was very evident that his Worship, the Chairman of the Water Committee (Alderman J. Lemon), and other members of the Corporation were glad of this opportunity of doing honour to their Water Engineer. Contrary to our custom, we must record a few remarks made by the President in replying to the toast of "The British Association of Water-Works Engineers." He said it was only about three years since that the Association began to exist; and yet the members now numbered close upon 200. To the care of those members was confided the water supply to upwards of 11½ millions of people; and the money that had been spent upon the works they managed amounted to no less than 40 millions.

On Wednesday afternoon a visit was paid to the South Hants Water-Works at Timsbury, where the members were also very hospitably received. Much interest was shown by them in the arrangements for softening the water—the process employed being Clarke's in its unmodified form. The cost of treating the water, we understand, is found to average from 1d. to 1¼d. per 1000 gallons. In the evening, the annual dinner took place at the Dolphin Hotel; the Association being honoured by the presence of the Mayor, the Sheriff, and other distinguished local gentlemen.

Thursday afternoon was devoted to a visit to the Southampton Water-Works at Otterbourne, which were entirely designed by, and carried out under the direction of, Mr. Matthews.

A longer excursion was undertaken on Friday—the works visited being the Foxbury station of the Gosport Water Company, and the Havant and Bedhampton stations of the Portsmouth Water Company. Altogether a most instructive and enjoyable day was spent. The outward journey was made by train and brake, and the return by boat from Southend Pier.

THE PROTECTION OF UNDERGROUND WATER SUPPLIES.

At the Meeting of the Society of Engineers on the 4th ult., a paper on the above subject was read by Dr. JOHN C. THRESH, the Medical Officer of Health to the Essex County Council.

The author pointed out in the first place that recent outbreaks of epidemic disease, due to polluted water supplies, have demonstrated in a terribly emphatic manner that there is either much wilful carelessness which requires to be rebuked, or much ignorance which needs to be dispelled. The discoveries of bacteriologists have proved that these water-borne diseases are due to specific organisms, which may gain access to, and be carried by, a water otherwise organically pure, as well as by an organically contaminated water, though the latter water will almost certainly be more liable to specific pollution, and therefore be more dangerous. Underground water is derived from that portion of the rainfall which passes by percolation into the subsoil. In this country, nearly the whole of the exposed surface of the permeable strata is under cultivation; and on account of the facility with which water is obtainable, the population thereon is considerable. The subsoil water must therefore be contaminated at its source; and were it not that there are powerful natural agencies at work capable of producing perfect purification, underground waters would be too dangerous to be utilized for public supplies. Where such water is collected in close proximity to houses, from wells sunk in a sewage-sodden subsoil, it is notoriously liable to pollution, and is a prolific cause of the dissemination of disease. The records of the outbreaks of typhoid fever and cholera in this country are sufficient proof of this. These impurities, however, are not carried far in a compact permeable subsoil, though in a fissured stratum they may be conveyed very considerable distances. During the progress of the polluted water through the subsoil, the organic matter becomes broken down, and finally oxidized or burnt up; the ashes (carbonates, chlorides, phosphates, and sulphates) alone remaining to afford evidence of the previous contamination. The particulate matter, including the micro-organisms, is more or less completely moved by the process of natural filtration implied by the percolation; and it seems certain that specific organisms gaining access to the subsoil water speedily perish. There is no record of any outbreak of typhoid fever being caused by underground water taken from a wisely selected and properly protected site.

Dr. Thresh went on to show that the investigations of Pettenkofer, the researches of Hanser, and the recent experiments of Martin and Robertson, all tend to prove that the

typhoid and cholera bacilli can only flourish near the surface and in a polluted soil; and Fraenkel has shown that the subsoil, even where the ground above has been grossly contaminated for a long period, is quite free from germs. This result, the author stated, he had recently been able to confirm in the examination of sand taken from various depths below the ground surface. At 4 feet, very few organisms were found; below 5 feet, none were discovered. These facts, he remarked, supported Koch's statement that "we have no reason to keep out of consumption the subsoil water which can be found nearly everywhere. On the contrary, we cannot find a better filtered water, and one more protected against infection."

Though the use of water from shallow wells sunk in populous neighbourhoods is not to be commended, Dr. Thresh thinks there is very little doubt that in many such places a perfectly safe water can be obtained from the subsoil, from a properly constructed well, with clean immediate surroundings. Shallow wells, supplying only a few houses, draw water from an exceedingly limited area—the cone of depression rarely exceeding 5 or 6 feet in diameter; and it is the ground surface over that cone which requires special protection. A shallow well yielding 45,000 gallons of water per day, and depressing the water-level 9 feet, will produce a cone of depression with a base about 34 feet in diameter in a sandy subsoil. Round such a well there should be a protective area with a radius of 30 feet, upon the surface of which no contaminating matter should be deposited, and which should be so guarded as to prevent the public from having access. Encircling this should be an outer zone, which might be used for grazing purposes, but not otherwise manured. The area of this outer zone would have to be decided upon in each case after a due consideration of all the factors involved, such as the contour of the ground, the direction of flow of the ground water, the depth and fluctuations of the water-level, &c. In certain cases, an elliptical area would be preferable to a circular one, especially in the case of springs. Where collecting channels feed the well, these should be not less than 10 feet below the ground surface, and be included within the protective area, and within the inner zone of that area if possible.

Where wells are sunk in fissured strata, the form and extent of the protective area require even more careful consideration, and should include the surface at which the fissures are most likely to outcrop. The water from the more freely-flowing fissures should from time to time be examined, to ascertain whether any show signs of contamination; and if, after a heavy rainfall, the water becomes in the slightest degree turbid, danger is indicated. In the construction of deep wells, the greatest care should be taken to exclude subsoil water; and, further, an area round the well should be protected, so that if any subsoil water does gain access it would be free from the possibility of specific pollution. Dr. Thresh said the use of the bore-tube as the pump suction-pipe was not to be commended, since the external atmospheric pressure would force air or water through the most minute aperture. Where the outcrop of the stratum yielding the water was within a few miles, it should be subject to examination, as impurities entering fissures might travel such a distance.

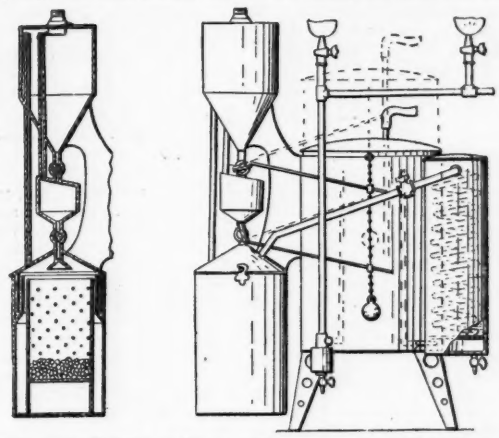
Whether underground water be drawn from a deep or a superficial stratum, the chief factor in guarding it from pollution is the provision of a protective area round the well or spring, under the absolute control of the purveyors of the water; the inner portion of the zone immediately surrounding the source being so protected that no tramps or hop pickers, or even the general public, could gain access. Existing sources of supply should be examined, and steps taken, if necessary, to secure adequate protection. Where, unfortunately, protection is impossible, the author thought it would be better to voluntarily abandon the works than wait until an outbreak of disease aroused public indignation, and, as a consequence, compelled their relinquishment.

River Plate Gas Company, Limited.—The first annual general meeting of this Company was held on Monday, last week, at Winchester House, E.C.—Mr. A. E. Bowen presiding. In moving the adoption of the report (*ante*, p. 1149), the Chairman reminded the shareholders that it was agreed that the businesses and properties of the Argentine Gas Company and the Belgrano (Buenos Ayres) Gas Company should be taken over as from Jan. 1, 1896; but the negotiations required a long time to complete, and it was not possible to register the Company in England until June 2 of last year. As a consequence, their Articles of Association were not accepted and approved by the Argentine Government before November, though he was bound to acknowledge that the Board met with no difficulties of any importance on the other side. It was, therefore, not until the beginning of the present year that they were enabled to get the combined businesses organized under one management; and so none of the economies and few of the advantages expected to result from the amalgamation were visible in the accounts for the period under review. They had to compete with four electric light companies; but he was glad to say that so far the consumption of gas had not fallen off. The development of the business in the outskirts of the city more than compensated them for loss of customers in the centre. The gross profit for the year was £80,352 (or £352 more than was foreshadowed in the prospectus), to which had to be added £30,907, the balance brought forward from 1896. After payment of the fixed charges, and making full allowance for bad and doubtful debts, there remained to be dealt with £87,680. This it was proposed to deal with as explained in the report. Mr. C. P. Ogilvie seconded the motion; and, after a short discussion, the report was adopted.

REGISTER OF PATENTS.

Generating Acetylene.—Patterson, J. J., of Batavia, N.Y., U.S.A. No. 10,686; April 29, 1897. Date claimed under International Convention, Dec. 22, 1896.

This apparatus for generating acetylene gas has for its object "to provide a reliable and compact apparatus of the kind wherein the generation of the gas is regulated by the rising and falling of the holder in which the gas is stored." An important feature of the invention consists in providing between the gas generating receptacle and a closed water-supply tank, an intermediate receiver for water, the inlet and outlet of



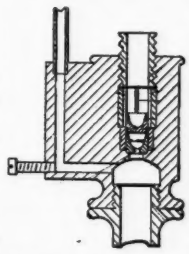
which is controlled by cocks or valves arranged so that when one is closed the other is opened. This contrivance ensures that the water shall not be wasted should the holder sink owing to the calcium carbide in the generator being used up without being noticed by the attendant.

One construction of the apparatus is illustrated; but a modification is described in the specification, where two or more generators are so arranged that, in case the gas gives out in one, the water can be admitted into the other, and so avoid interruption of gas supply.

Incandescent Gas-Burners.—Bartlett, F. G., of Bristol. No. 13,191; May 28, 1897.

This invention is a development from a former arrangement patented in 1896, No. 23,454, according to which invention a series of burners can be controlled by a bye-pass main cock or tap common to the series—each burner being provided with the usual pilot light.

According to the present invention two cup-shaped valves are contained in the chamber below the nipple or burner-head, and are free to rise and fall in the slotted sleeve with which the chamber is fitted. When gas is not passing to the burner, the two valves are at their lowest limit of travel, and one rests closely upon the other, so that no gas can pass between them. The lower valve is heavier than the upper; the weight of each valve being determined by the pressure at which it is intended the valves shall act. Through the bottom of the lower valve is an aperture; and when a sufficient pressure of gas is admitted to the gas-supply pipe connected to the valve chamber, the upper valve rises to the limit of its travel—leaving the lower valve at the bottom of the chamber.



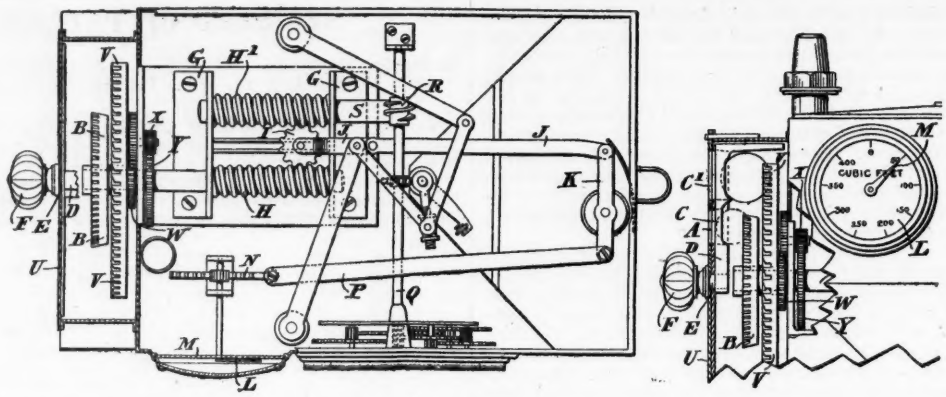
The gas passing through the aperture into the space between the two valves, flows to the burner through the slots in the sleeve as in the 1896 patent. If, however, a sufficient further pressure of gas be admitted from the supply-pipe, the lower valve is raised from its seat into contact with the previously raised valve; communication by the aperture in the lower valve is again closed; and the passage of gas through the slots in the sleeve, and thence to the burner, is permitted to the maximum extent which the valves are designed to allow.

Coin-Freed Gas-Meters.—Glover, R. T. & J. G., of St. John Street, Clerkenwell, E.C. No. 15,358; June 26, 1897.

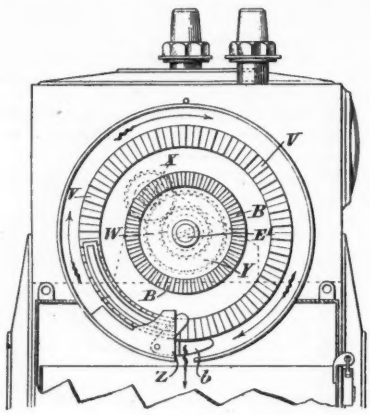
This invention has for its object to arrange a system of gearing in connection with the price changer, coin pocket, and valve operating mechanism of a coin-freed gas-meter, so that coins of different values may be used in one and the same meter—the mechanism allowing "a proportional quantity of gas to flow to the consumer's pipe according to the value of the coin inserted without any special setting of mechanism or knowledge on the part of the consumer." The patentees arrange the coin-actuated mechanism in conjunction with one price changer to receive any number of different values, or separate price changers for each coin of different values; but in all cases "the mechanism actuated by each coin is interlocked with the mechanism operable by every other coin."

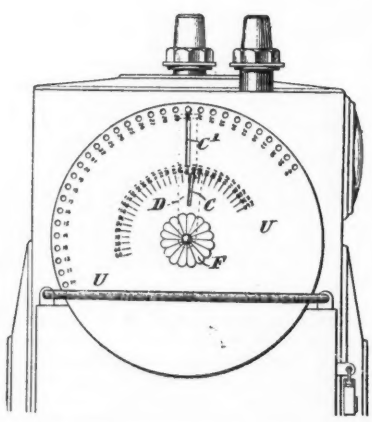
The illustrations (next page) show: (1) The coin-operated mechanism and meter-reversing mechanism. (2) A part section of the meter casing indicating the gearing-down mechanism for a coin of lower value, also the mechanism for a coin of higher value—say a sixpence in lieu of a penny, either of which can be inserted into the receiver wheel and the button or handle operated to move the gas-valve for the respective proportional quantity. (3) A front elevation of the coin-operated mechanism; the meter casing being partly removed for this purpose. (4) A front outside elevation of the meter showing the price changer front plate, and having slots through which either of the two coins could be inserted at the will of the consumer.

A coin—say, a sixpence—is pushed through the slot A, and engages a notch in a wheel B; the coin also resting in a pocket C of a lever D fixed



on the spindle E of the turn-button or handle F, projecting from outside the meter casing for ready manipulation as desired. There is another (or worm carrying) spindle extending into the space above the belly of the meter, and between the supports G. It is provided with a long scroll or worm H, which, when turned with the spindle, causes the pinion I to travel towards the front of the meter, drawing the bar J, on which it is mounted, along with it. This bar, by its connection with the valve lever K, opens the gas passage for flow through the meter for ordinary consumption; the distance to which the valve is opened being determined by the number or value of the coins inserted and the mechanism operated for each one. The amount of gas to be consumed for each coin inserted is recorded on the dial L through its indicating finger pinion M, in gear with the rack N of the bar P on the opposite end of the valve lever K.





The pinion I when rotated merely, so to speak, walks along the worm H^1; this being stationary and immovable during the movement of the worm H. But so soon as the gas is being used, and no more coins inserted, the worm H becomes the stationary one, and the worm H^1 rotatory, due to the working of the meter mechanism operating through the spindle and gear P, by which the usual quantity counter-index appliances are actuated. The shaft Q carries a short worm R in gear with a pinion on the axle S of the long worm H^1, which by its rotation causes the pinion I to travel along a walk over the long worm H. In so doing it reverses the direction of the travel of the rods or bars J P, and so gradually moves the valve until it finally closes the passage; the consumer's quantity dial (L) finger M being "simultaneously, gradually, and finally" returned to zero when all the gas previously paid for has been consumed. Thus far the system of operating the mechanism is substantially the same as that described in patents Nos. 8327 and 22,830 of 1894, except in so far as the position of the actual coin receiving slot is concerned. In those cases a single slot only was provided for one kind of coin; but in the present system there are two slots in the price changer face plate U—one for a small coin, and the other for (say) a penny. In connection with the notched disc V at the back is a pinion W arranged to gear into an otherwise idle wheel for transmitting its motion by its axles pinion X to a wheel Y on the spindle of the first motion worm H.

The gear, or pinions, and wheels W and X have the required number of teeth for reducing the rotation of the spindle when a penny is used to (say) a sixth of that given to it when a sixpence has been inserted. Consequently the result will be the same whether a sixpence or six pennies be inserted—the same turn-button or handle F and the same lever D (having the two pockets) being operated whether a coin be placed in the lower slot C or into the upper slot C^1.

Z is a fixed stop, against which the end of the pocket lever D comes into contact, and which enables the coin carried round by the notched disc B or V, as the case may be, to be discharged; and there is a brake under the point of which the end of the pocket lever D can ride to force it into contact with the edge of the notch disc V, and thus arrest its motion and prevent it going beyond its restricted distance. A spring pawl engages the hollows or notches in the disc to prevent its back rotation from any cause; one edge of each notch being chamfered to enable them to slip under the pawl when travelling in the proper direction.

APPLICATIONS FOR LETTERS PATENT.

11,101.—Jones, F. J., "Improvements in gas-fired furnaces." May 16.

11,134.—Lallement, C., Trichet, E. L., and Marcellot, E., "Improvements in gas or petroleum motors." May 16.

11,161.—Strode, W. W., and White, G. H., "Improvements in or relating to the production of acetylene gas." May 16.

11,171.—Williams, A. B., "Acetylene lamps." May 16.

11,201-2.—Brookes, A. G., "Improvements in and relating to coin-freed apparatus or prepayment attachments for gas or other fluid meters." Communications from Henry G. Thompson, Harry G. Thompson, and S. E. Mower. May 17.

11,222-5.—Price, H. A., and Turner, H. C., "Improvements in gas-stoves." May 17.

11,248.—Nicholson, R. T., "Improvements in connection with the generation of acetylene gas." May 17.

11,261.—Kieffer, F. A., "Acetylene gas generators." May 17.

11,287.—Benkel, L., "Coin-freed delivery apparatus." May 17.

11,292.—Meza, J. de, "Electrical gas lighter." May 17.

11,297.—Chandler, S., jun., and Chandler, J., "Improvements in incandescent gas-burners." May 18.

11,320.—Urquhart, R. J., "Improvements in electrical ignition apparatus for gas-burners." A communication from the Actiengesellschaft für Fabrikation von Broncewaaren und Zinkguss, vorm. J. C. Spinn and Sohn and Stanislaus Johann von Romocki. May 18.

11,359.—Cars, B., "Improvements in or connected with chimneys for gas and other burners, and in the method of producing the same." A communication from Rudolf Inwald. May 18.

11,367.—Shackleton, J., and Ross, A., "Improvements in apparatus for generating and purifying gas." May 18.

11,377.—Fowler, T. R., "Improvements in apparatus for the manufacture of acetylene or the like." May 19.

11,389.—White, J., "Improvements in apparatus for generating, purifying, and storing acetylene gas." May 19.

11,422.—Hope, G., "Improvements in or relating to generators for acetylene gas." May 19.

Water Supply for Crich.—A few months ago, the Belper Rural District Council invited competitive schemes for supplying water to the parish of Crich, a district containing about 3000 population. Ten schemes were submitted, and the Council decided that the one submitted by Mr. H. W. Taylor, Assoc.M.Inst.C.E., of Newcastle-on-Tyne and Birmingham, was the most suitable. It was accordingly adopted; and Mr. Taylor was engaged as Engineer for the execution of the work. The scheme consists of pumping water from a deep well sunk in the millstone grit, into a concrete reservoir of 50,000 gallons capacity. Treble-barrel pumps, driven by gas or oil engines, will be used; the machinery being in duplicate. The cost of the scheme will be about £3000.

Projected Improvements at the Goole Gas-Works.—At their last meeting, the Goole Urban District Council had before them a report by the Gas and Water Committee recommending the adoption of certain proposals made by their Engineer (Mr. Matt. Dunn) for improving the gas-works. They comprise six beds of retorts, alterations to the retort-house, and duplicate engine and exhauster, and other matters. The Committee also suggested the holding of a gas exhibition. It was explained that the contemplated alterations would involve an expenditure of between £4000 and £5000. But it was pointed out that the outlay would make the undertaking more efficient, and enable the Manager to produce better results, so that, instead of imposing an additional burden upon the ratepayers, it would really be putting something into their pockets. The report was adopted. Mr. Dunn will now proceed with the necessary drawings.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Sunday Labour in Gas-Works (Dr. Gritton's Fund).

Sir,—I beg to thank those members of the gas profession who have responded to this appeal; also the stokers in a few works, who gave towards a penny subscription.

I regret to state, however, that no shareholders (with the exception of myself) have given anything—in their private capacity, of course. I would ask Directors and shareholders throughout the country if they could do something in this matter. A moral responsibility rests upon them (especially the former) to abolish all preventable Sunday labour. Dr. Gritton has, from 1869 to the present time, done a great deal in this direction—stirring up the question about every ten years. To this end he availed himself of the aid of practical men; and finally in 1897 he embodied the results in a pamphlet. This pamphlet was favourably reviewed in the "Journal" for Nov. 23, which I would ask those who may feel interested by this letter to refer to. I am certain that among so large a body as Directors and shareholders in gas companies, there are some who will acknowledge a just claim, and give towards a fund being raised for the benefit of a man, who has done what really devolves upon them.

The list will be kept open for a month longer; and subscriptions can be sent to Mr. A. Dougall, Gas-Works, Tunbridge Wells.

May 27, 1898. A Gas Proprietor.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Bills on Monday last week, when the House adjourned for the Whitsuntide recess:—

Bills read a second time: Gas Orders Confirmation Bill (No. 2), Water Orders Confirmation Bill.

Bill reported, with amendments: Carlisle Corporation Water Bill.

Bills read the third time and passed; Folkestone Water Bill, Halifax Corporation Bill, Kettering Water Bill, Tynemouth Corporation Water Bill.

Bills Royal Assented: Aberystwyth Gas Bill, Edinburgh and District Water Bill, Edinburgh and Leith Corporations Gas Bill, Folkestone Gas Bill, Hartlepool Gas and Water Bill, Morley Corporation Gas Bill, Swansea Gas Bill, Waterford City Gas Bill, Whitwick and Coalville Gas Bill.

The Thanet Gas Bill has been re-committed to the Select Committee who recently had it under consideration, and decided that it should not be allowed to pass (see *ante*, p. 1198). It will again come before them on Friday, the 10th prox.

HOUSE OF COMMONS.

The following further progress was made with Bills down to the adjournment for the Whitsuntide recess last Tuesday:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Bacup Corporation Water Bill, Folkestone Water Bill, Halifax Corporation Bill, Hamilton Water Bill, Kettering Water Bill, Tynemouth Corporation Water Bill.

Bills read a second time and committed: Blackpool Improvement Bill, Market Harborough Gas Bill.

Bills reported: Cromer Gas Bill, Drogheda Gas Bill, Gainsborough Gas Bill, Matlock Urban District Council Bill.

Bills reported, with amendments: Liskeard Corporation Water Bill, Yeovil Corporation Bill.

Bill read the third time and passed: Bakewell Gas Bill.

Sir F. Dixon-Hartland has given notice of his intention to ask the President of the Local Government Board, when the House resumes on the 6th prox., whether he is aware that, where the London Water Companies make new reservoirs by permission of the House, they claim the right to have the land they have taken for the purpose rated at one-fourth of the ordinary assessment, on the ground that it is land covered by water, and therefore the parishes in which these reservoirs are situated are in reality deprived of three-quarters of their rates; and whether he will in future insist upon the insertion of a clause preserving the rights of the local authorities in this regard.

Middleton Corporation Gas Supply.—The Manager of the Middleton Corporation Gas-Works (Mr. Tim. Duxbury) has issued his working statement for the year ending the 31st of March. The total quantity of gas sold was 91,387,100 cubic feet, as compared with 87,118,000 cubic feet in 1896-7. The capital employed was £105,562; being £10 11s. 1d. per ton of coal carbonized, and £1 3s. 1d. per 1000 cubic feet of gas sold. On the same bases, the cost of coal and the working expenses (less residuals) come to 15s. 8·06d. and 20·68d.; the gross profit being 11s. 2·97d. and 14·84d., and the net profit 1s. 9·65d. and 2·31d. The price of gas was reduced in June, 1896, and again last summer, at a cost of £879 and £658 respectively.

New Joint-Stock Companies.—The Worle (Weston-super-Mare) Gas Company, Limited, has been registered with a capital of £4000, in £10 and £5 shares. The South African and Australasian Sunlight Gas Syndicate, Limited, with a capital of £10,000, in £1 shares, will work the invention of Mr. R. Goodwin, of Dublin, consisting of a gas plant and system to produce acetylene gas, or acetylene and carbonic acid gas combined, in Cape Colony, Natal, the Transvaal, the Orange Free State, and other South African and Australian colonies. The Automatic Light-Controlling Company, Limited, with a capital of £10,000, in £1 shares, has been formed to undertake the manufacture of apparatus for controlling and regulating electric light and gas.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, May 24.

(*Before Mr. Justice* Bigham.)

Barton v. Beal and Others—Mains under Private Roads.

In this case the plaintiffs, Messrs. Barton Bros., who carry on business as wholesale ironmongers at 196, Old Kent Road, S.E., sought for an injunction to restrain the defendant, Mr. Samuel Beal, an engineer and brass finisher, of Wilmot House, Old Kent Road, and the South Metropolitan Gas Company, from laying down or permitting any gas mains or pipes used in connection with the defendant's premises to remain laid under a private road belonging to the plaintiffs. An injunction was also asked for against the defendant Beal in like manner with respect to a water-main.

Mr. Eve, Q.C., and Mr. Cann appeared for the plaintiffs; Mr. A. Birrell, Q.C., and Mr. Stokes, for Mr. Beal; Mr. Astbury, Q.C., for the South Metropolitan Gas Company.

It appeared that the plaintiffs and the defendant Beal purchased their respective properties from a common owner in 1887; and that the plaintiffs' property included a private road over which Mr. Beal had a right of way to his property. The plaintiffs complained of the excessive use of this right of way by Mr. Beal, in that he had widened the gate at the end of the road, thereby allowing for the passage of heavier vehicles; and also that the presence under the right of way of the gas and water mains was altogether outside the grant, and constituted a trespass. When the plaintiffs bought the property, there was already existing under the road in question a 2-inch gas-pipe; but this was not known to them till some time afterwards, when they learnt that the Gas Company, in order to give Mr. Beal a better supply of gas to his house, had taken up the pipe, and replaced it with a 3-inch one. On behalf of Mr. Beal, it was contended that he had a right of way in the widest terms known to the law. For the Gas Company, it was urged that they were bound by statute to give their consumer, Mr. Beal, an adequate supply of gas; and that for this purpose it was necessary to put in a larger pipe than the one which had been laid some forty years ago.

Mr. Justice Bigham, in giving judgment, said he was satisfied that, as a matter of fact, the water and gas mains, as they were originally placed, were within the meaning of the section of the Act of Parliament appurtenant to the property of the defendant Beal's house; and therefore there was no original wrong done to the plaintiffs by their existence. As to the alteration in the size of the gas-pipe, this might fairly be called an alteration within the meaning of the Gas-Works Clauses Act. As to the gate, he did not believe that its enlargement had caused any increase of the traffic at all. Under these circumstances, the action would be dismissed, with costs.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, May 24.

(*Before Justices* Wills *and* Kennedy.)

Horn v. Sleaford Union and Others.

To-day Mr. Justice Wills read his judgment in this case, which raised a question as to the payment for water in a Rural Authority's district (see *ante*, p. 1146).

Justice Wills said the village of Heckington was one of a group of parishes in the area of the Rural District Council of the Sleaford Union. The Council had provided a supply of water for the village; and in respect thereof they had charged water-rates, on the security of which they had borrowed, with the sanction of the Local Government Board, a sum of £1350 for constructing and maintaining the works. They were liable to repay this amount by instalments, with interest; and certain instalments becoming due, they made a rate on the whole of the parish of Heckington, including the appellant, who was a farmer owning land and buildings some three miles away from the village. He, however, objected to paying it, and said the rate ought only to be made on those who consumed the water. His objection was that the whole of the cost, both of construction and maintenance of the necessary works for a supply of water generally, must be paid out of the water rates or rents, as far as was possible, by the consumers; and that the expression "if and so far as the expenses are not defrayed out of the water-rates" implied that there might be a balance not covered by these charges which was intended to mean such trivial portion of the expenses as fell within the proviso of section 230. He (Justice Wills) could not think this view was right. If the whole expense fell on the consumers, they would try to do without the water; but it was impossible to suppose that anything of the sort was intended. It was the essence of legislation of this kind that works necessary and desirable for the sake of health should be paid for by the inhabitants at large, though the direct benefit might only accrue to a small portion of them. The expense of works was frequently too heavy to be borne by only those directly benefited; and had they to be so borne, they very often could not be carried out at all. The whole of the community benefited indirectly. It was of no purpose to put extreme cases, and say that very unreasonable things might be done by a local authority. All legislation which conferred powers of this kind on local authorities assumed that they were bound to act reasonably; and he was not himself disappointed in this expectation, judging from his experience in the large number of cases which had come before him. Legislation of this character was naturally of very wide and general application; and though it might appear to the appellant hard that he should have to pay for the cost of works to supply water to people three miles off, the operation of such general enactments could not depend upon whether a parish was one mile or ten miles long. It could not be intended that the costs and expenses of providing the supply should be paid only by the people who used the water. He was therefore of opinion that the rate was rightly made, and that the appeal must be dismissed, with costs.

Justice KENNEDY said he had had an opportunity of considering the judgment of his learned brother just delivered, and agreed generally with it. He desired, however, as the case was one of some importance, to add a few words. They were asked by the appellant to say that it was incumbent upon the Rural District Council to pay the instalments of principal and interest due on the loan by means of water rates and rents to be charged to the consumers of water only, including therein the persons who were made chargeable under section 9 of the Public Health (Water) Act, 1878. The respondents contended that it was not in their power to do this, and further that, even if it were, it was not incumbent upon them to take such a course. It was on these contentions that their judgment was asked. In his view, it was clearly not incumbent upon the respondents to put the whole burden, not merely of the cost of supplying the water, and the maintenance of the works, but the capital expenditure of providing the works, as well as the interest on this expenditure, upon the private consumers. There was no statutory direction that this should be done; and, for the reasons given by his learned brother, and especially having regard to the fact that in this case—and he supposed in most cases of the kind—the capital had been laid out to supply not merely the wants of the private consumers, but those of the community at large with regard to public purposes, he should think it would be often unjust as well as impolitic, in the interests of the public health, that such compulsion should exist. The appeal would therefore be dismissed, with costs.

Mr. FITZGERALD (for Mr. Horn) asked for leave to appeal.

Their LORDSHIPS refused to grant it; saying that it was not desirable to encourage such appeals.

NORTH LONDON POLICE COURT.—Thursday, May 26.

(*Before Mr.* BROS.)

Charge of Stealing Gas.

To-day Joseph Lickfold, a plumber and gas-fitter, of 62, Junction Road, Holloway, was charged with stealing gas belonging to The Gaslight and Coke Company.

Mr. HUMPHREYS prosecuted; Mr. G. B. HOWARD appeared for the accused.

Mr. HUMPHREYS said that though he only charged the prisoner with stealing 1000 cubic feet of gas, worth 3s., he would ask the Magistrate to draw the inference that it was a very much more serious case than appeared on the face of it. The Company did not know how long the thing had been going on; and it was only accidentally discovered. To meet the increased price of gas, the Company had sent round a fitter with the automatic gas-meter collectors, to alter the mechanism, and when they came to the prisoner's house they found that a contrivance had been fixed up to prevent the gas from the service-pipe passing through the meter to the supply for the house. The service-pipe had been unscrewed, and the hole in the meter plugged up. A composition pipe had been fixed to the service-pipe, and then passed round the meter to the other pipe. The attention of the prisoner was called to this extraordinary state of things; and he immediately began to put the meter into its normal condition.

Frederick Stanborough, the fitter in question, was called, and produced the meter and fittings, and pointed out to the Court the means by which the alleged fraud had been effected. He expressed an opinion that, from the condition of the joints, this had been going on for some time.

In cross-examination, witness stated that the prisoner said there was water in the pipe, and he could not get any gas to boil a kettle of water. But, as a fact, there was nothing the matter with the supply. The prisoner said, "Take no notice; I was only boiling a kettle of water." The service-pipe had plier marks more than was usual.

Mr. *H. T. Clark*, the collector who accompanied the fitter, said that immediately on his entering and asking for the rent of the gas-stove a workman in the prisoner's shop jumped off the bench and ran out. The prisoner very soon afterwards made his appearance, and snatched off the piece of temporary piping spoken of. He found the inlet-pipe to the meter hanging loose; and, turning to the prisoner, he asked for the temporary piping which he had taken off. The prisoner produced a piece which he (witness) did not think was the same. He told the prisoner he had been very silly in doing this, and that he would have to answer to others for it. The prisoner said he was only boiling a kettle of water for his wife, who was ill upstairs. The books of the Company showed the prisoner's consumption of gas last year from Dec. 27 to March 26 to be 10,300 cubic feet; while the consumption from Dec. 26 to March 26 last was only 7625 cubic feet.

By Mr. HOWARD: The prisoner said there was water in the pipe, and the supply was defective, and that this was the reason for fixing the extra pipe.

Mr. *A. M. Box*, gas inspector, said he had a conversation with the prisoner on the subject; and the latter replied: "I only put on the connection for the supply to a bath, and I have only used a hap'orth of gas." He (witness) asked where the hole in the ceiling was for the supply to the bath; but to this there was no reply. The prisoner said he found the gas defective, and fixed the temporary connection to put it right.

Mr. *C. H. Deitchman*, another inspector who visited 62, Junction Road, said he found the meter properly connected. He made a sketch of the condition of the meter, and asked the prisoner why he did this. Prisoner answered: "My daughter was cooking, and could not get any gas." He afterwards said: "There was water in the pipe."

By the MAGISTRATE: The extra pipe was useless with the object of putting the supply right, even though it was wrong.

Detective BAKER, who arrested the prisoner, said the latter made reply: "It is a mistake. I put the piece of pipe on to blow water out. I have done it before with other people's meters. It is a bad job for me."

His Worship sent the case for trial; but accepted £40 bail, and the accused in £40.

The recent issue by Messrs. Richmond and Co., Limited, of £30,000 of 4 per cent. debentures was, we are informed, more than subscribed for in Warrington alone.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY AND THEIR CONSUMERS.

The Agitation against the Increase in the Price of Gas.

Last Wednesday, a public Meeting, convened by a Joint Committee of the Holborn District Board of Works and the Vestries of Clerkenwell and St. Luke's, was held in the Holborn Town Hall, to protest against the recent increase in the price of gas by The Gaslight and Coke Company to their customers north of the Thames. Sir A. K. Rollit, M.P., presided, and resolutions of sympathy were read at the outset from a number of Vestries as well as from the District Boards of Poplar and the Strand. Many London Members of Parliament also wrote expressing sympathy, including Mr. E. H. Pickersgill, who stated that the President of the Board of Trade had practically promised that if he would move in the House of Commons for a Select Committee to inquire into the working of the Company, the Government would support it. The Chairman said he presided at a similar meeting of protest four years ago; and its success should be a source of encouragement to them. The increase in price had been progressing from 1876, and had risen from 2s. 6d. to 2s. 8d., 2s. 10d., and four years ago to 3s. Their emphatic protest then resulted in a reduction, and also in the abolition of meter-rents. He could not help thinking that one of the reasons for the present increase was mismanagement on the part of the Company's officials. The Company had drawn some two millions of money beyond their statutory dividends; and he was prepared to declare that they gave a "fraudulent preference" to South London in this matter. The increase bore hardest on the penny-in-the-slot consumers, with whom it was 12½ per cent., against 5 per cent. for the ordinary customers. He thought the reason for the injustice was the statutory monopoly; and it was their duty to ask if it should any longer continue. Mr. H. C. Richards, M.P., moved—"That, in the opinion of this meeting, the difference of 9d. in the price of gas made by The Gaslight and Coke Company—viz., 3s. to consumers on the north side of the Thames and 2s. 3d. on the other side—is absolutely unfair." He thought the increase was particularly hard on working men; and he expressed the hope that there would be a parliamentary inquiry. Mr. J. Rowlands (President of the Gas Consumers' League) seconded the motion; and it was carried unanimously. Other resolutions were adopted, calling for a parliamentary inquiry, and requesting the Holborn District Board of Works to present a petition on the subject to the House of Commons.

STAFFORD CORPORATION GAS AND ELECTRICITY SUPPLY.

The Past Year's Working.

In the "JOURNAL" last week we noticed briefly the annual report of the Gas and Electricity Committee of the Stafford Corporation, which was presented at the meeting of the Town Council on the previous Tuesday. We have since received from the Engineer (Mr. J. Ferguson Bell) a print of the report, which furnishes a few additional particulars.

In the financial year ending the 31st of March, the output of gas was 148,275,000 cubic feet, which, notwithstanding the mildness of the winter and the competition of the electric light, was an increase of 4,772,000 cubic feet on that of the preceding twelve months. The total receipts for gas were £17,684; being £341 more than before. A portion of this—£159—is due to fortnightly and prepayment consumers, who now number 1000, and who furnished £1158 of the entire receipts. Less coal (by 351 tons) was carbonized last year; and consequently the production of residuals was less. The net amount received for them was £3813—a decrease of £150. The total receipts from all sources in the Gas Department were £21,560, or £182 more than in 1896-7. With regard to expenditure, the cost of coal (15,242 tons) was £6724—an increase of £388; but, as already remarked, nearly 4¾ million cubic feet more gas was produced. The total expenditure (including £1038 for the depreciation fund and £877 for rates) was £14,275; leaving a gross profit of £7285—being equal to more than 10 per cent. dividend on £71,545, the present loan indebtedness of the undertaking. Out of this sum there has been paid £2709 19s. 10d. for interest, and £2672 15s. 1d. for repayment of loan, £260 7s. 11d. for income-tax, and £40 premium on the purchase of annuities; leaving a net profit of £1602. This, added to the balance brought forward, makes £1604 available for disposal. It being still necessary to give as much aid as possible to the district rate, the Committee recommended that £1500 should be paid to the fund, £100 to the reserve fund, and the balance carried forward. The total amount now paid in reduction of capital is £31,038, and the sum handed over in relief of the rates will be £31,800; while the amounts paid to the depreciation fund, out of which the works are maintained in their present satisfactory condition, total up to the large sum of £17,404. These three amounts equal the capital paid for the works in 1879. As the Committee anticipated, the first year's competition of the electric light somewhat retarded the growth of the Gas Department; but, now that the former rate of progress is again apparent, they think there is no reason to doubt that each succeeding year will show a still further increase.

With respect to the Electricity Department, the Committee report that the increase in the sale of current was very marked in the past year. There is now the equivalent of 6200 8-candle power lamps connected, as against 5003 in 1896-7; and the current sold was 55,542 units—an increase to the extent of no less than 27 per cent. But the low tariff of charges fixed last May has seriously affected the revenue. The sale of current amounted to £1202, as against £1162 last year; being an increase of £40, or only 3½ per cent. The rent of meters, &c., and rents from property, make the total receipts £1292. The total expenses amounted to £765; leaving a gross profit of £527. Adding to this a sum of £897 brought forward, the total standing to the credit of the Electricity Department at the close of the year was £1424. Out of this the Committee paid £556 for interest, £436 in repayment of loans, and carried forward £432. The total amount borrowed was £20,000, and the sum repaid is £1272; the debt on the capital account now being £18,728. The electric mains are now practically at their limit; and if the demand for the electric light

continues to increase, it will be absolutely necessary to incur considerable further expense in order to increase their capacity by doubling the pressure. The boilers, engines, and dynamos are ample for a much greater demand; and the Committee state that the whole installation is in the highest condition of efficiency.

In closing the report, the Chairman (Mr. W. H. Peach) acknowledges the pleasure he has derived during the past fifteen years from his connection with the Committee and the official staff attached to it, especially with the Manager. He also congratulates the town upon its possession of these lucrative undertakings, which if placed upon the market to-day would, he says, realize a sum more than sufficient to extinguish the entire debt of the borough. He trusts that the prosperity which has attended them until now may continue to steadily increase.

LANCASTER CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Engineer of the Lancaster Corporation (Mr. C. Armitage, Assoc.M.Inst.C.E.) has presented to the Gas Committee his report on the working of the undertaking in the year ending the 25th of March last. The revenue from the sale of gas for private and public lighting came to £17,166—a slight decrease on the former figures; residuals produced £5688; and the total receipts were £23,533. The expenditure being £16,704, there was a gross profit of £6829. After providing for interest, sinking fund, and income tax, there remained a net balance of £1080 to be transferred to the borough fund account. The revenue fund now stands at its maximum—£12,000. Nothing was added to the capital account last year; all new work being charged to revenue. Mr. Armitage states that prepayment meters continue to work satisfactorily with a steady demand, mostly from new consumers. Up to the date of the report, 647 had been fixed; and the receipts for the past year amounted to £597 13s. 2d., for a consumption of 3,872,826 cubic feet of gas. Appended to the report is an analysis showing that the cost per 1000 cubic feet of gas sold last year was 2s. 3·32d., apportioned as follows: Net cost of gas, 1s. 4·55d.; interest on stock and mortgages, 6·37d.; sinking fund, 2·63d.; to the borough fund, 1·77d.;—total, 2s. 3·32d. The average cost of coal and cannel was 11s. 3·37d. per ton; coke contributed in return 4s. 4·47d.; and the products from tar and ammoniacal liquor, 3s. 1·53d., making a return for residual products of 7s. 6d., or 66·48 per cent. of the cost of the coal. The prices of tar products suffered a further decline last year; but sulphate of ammonia advanced in price. The working statement accompanying the report shows that of the 154,451,000 cubic feet of gas made, 147,215,645 cubic feet were used; leaving 7,235,355 cubic feet, or 4·68 per cent., unaccounted for. In the production of gas, 12,865 tons of coal and 2305 tons of cannel were employed; the proportions being 84·8 and 15·2 per cent. The amount of capital engaged in the undertaking is £132,679; being £8 14s. 9d. per ton of raw material, and 18s. 1d. per 1000 cubic feet of gas sold. Each ton of coal produced 10,181 cubic feet of gas, of which 9628 cubic feet were sold, 12½ cwt. of coke, 10·68 gallons of tar, and 36·69 gallons of liquor yielding 29·53lbs. of sulphate of ammonia. The price of gas within the borough is 2s. 6d., and 2s. 9d. per 1000 cubic feet beyond; in each case with a discount of 3d. The gas used for the public lighting of the borough is supplied at the ordinary rate, but with 30 per cent. discount; outside the borough the price is the same as that charged to ordinary consumers. The Corporation give prepayment meter consumers 27 cubic feet of gas for 1d.; but with cooking-stove supplied and fixed free of charge, 22 cubic feet. Meters are put in free, and no rent is required for their use.

MONTE VIDEO GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Friday, at Winchester House, Old Broad Street, E.C.—Mr. A. K. Mackinnon in the chair.

The Secretary (Mr. A. G. Hounsham) having read the notice convening the meeting,

The Chairman moved the adoption of the report and accounts, which, he said, did not show so favourable a condition of affairs as those for 1896. The shareholders would have been prepared for this through hearing of the political crisis, culminating in revolution, which existed in Uruguay for some long time past, and the consequent effect on all business carried on there. It was pleasing, however, to find that this period was at length passing away, and an era of progress had commenced which could not fail in the future to lead to renewed prosperity. Dealing first with the balance-sheet, he said the Directors had written £958 off the capital account for depreciation, and had added £934 for expenditure during the year on new and additional mains and services and the cost of altering the Memorandum of Association in connection with the electrical powers they had obtained. The total value of stocks was £1594 less than in the previous year. The item of sundry debtors and outstanding accounts was a little higher; the total being £14,734. It included every outstanding private account for gas, residuals, fittings, and dock work, and for taxes which had to be paid in advance for the present year. It also embraced the current amounts owing by the Government Departments and by the Municipality for public lighting to December last, and also for an installation of gas lighting in the suburb of Pocitos. They were now in treaty with the Local Municipal Commission for the lighting of other streets in the district, which, if the negotiations were successful, would require 100 additional public lamps at least. The next item in the balance-sheet referred to the Government account to June 1890 (£5611), respecting which negotiations were pending with the new Government. Then the investments were some £2000 more than they were in the previous balance-sheet. On the debtor side, the redemption of the debentures to date, £9460, had been deducted from the reserve account of £74,000—leaving the amount at £64,540. The Directors believed the shareholders would agree with them in thinking that this cancelling of the debentures was a very good investment for part of the reserves, seeing how difficult it was nowadays to get 5 per cent. with safety. The insurance fund of £12,500 remained the same as last year. The item of sundry creditors at Monte Video and in London amounted to £277 more. The profit on the year's working was £18,034; and adding interest and discount to the balance brought forward, they had a total of £24,802. Deducting the provision for interest on debentures, loss on exchange, bad and doubtful debts, and for depreciation, there remained a balance of £19,959 available for dividend. In November last an interim dividend of 2½ per cent. was paid; and the Directors now recommended a similar distribution—making 5 per cent. for the year. This would absorb £27,096, and would require the withdrawal of £7136 from the contingency account, which would then stand at £18,137. The £7136 was somewhat less than the loss caused by the 12½ per cent. reduction in the price of gas for the year. The contingency account was the result of careful administration in past years. From time to time, some of the shareholders had objected to its retention; but the wisdom of having retained it must now be manifest to all. An item of £268 loss on exchange in the profit and loss account was due principally to the silver in which the gas accounts were paid being at a slight discount; but as the shareholders were aware, Uruguay currency was on a gold basis. Bad and doubtful debts were rather more than in the previous year—viz., £942, and were in part occasioned by consumers hurriedly leaving the country. Turning to the revenue account, he said the reduced expenditure in cost of manufacture, &c., was £3878. The revenue from the Company's dock was £6423 less, owing in great measure to the imports of the country having fallen off considerably. Having given the above details, he wished to recall to the recollection of the shareholders the fact that the result of the reduction in the price of gas in 1887 was a gratifying increase of consumption. Consequently the Directors had every reason to suppose that the next reduction in July, 1896, would have had a like effect. But the revolution introduced disturbing circumstances, which absolutely prevented what would otherwise undoubtedly have happened—viz., such an increase in the sales of gas as would have more than made up for the loss occasioned by the reduction. They were energetically pushing the use of gas for cooking and heating purposes, and had introduced prepayment meters. Gas as a motive power might also become a great success, and so improve the revenue. Referring to the improvement in the position of affairs in Uruguay, he mentioned that their General Manager had informed them that in April they had the satisfactory increase of 25 in the number of consumers; and up to the 23rd inst., a further increase of 31. Respecting the Electric Light Company, which had existed in Monte Video since 1887, he said it had passed through many vicissitudes, and was assisted by the two previous administrations, with the ultimate result that the present Government had to take it over to save some of the capital belonging to the Municipality, and had purchased the few shares that were outstanding in the concern. Desiring to save as much as possible from their heavy loss, the Government had transferred the usufruct of the concern to a Commission for the benefit of the Municipality. Experience had shown over and over again that the electric light and gas could run very well together; but the conditions under which they worked should be absolutely fair and equal. If they could be joined under one management, generally speaking so much the better. It was certainly his opinion that the best interests of the Government would be considered, and also the public benefited by some such mutually satisfactory arrangement. In view of the large fields that were opening for the extended use of gas for so many additional purposes, the great strides that were being made in developing the illuminating power, and the magnificent light which could now be given with reduced consumption, the Directors faced the future with confidence.

Mr. M. T. Hood seconded the motion.

Dr. Mulvany said he did not think that during the years he had been connected with the Company, he had ever seen a worse report than the present one. He was of opinion that the want of prosperity was not due to the circumstances to which the Chairman had alluded. Companies in the Argentine Republic had suffered more from locusts than those in Uruguay, and yet they had been more prosperous. The dividend had been reduced from 6 to 5 per cent.; and he asked the shareholders whether they were going to allow the concern to drift as it had been doing for some years. He ventured to say that the policy of the Board during the past twenty years, and more especially in the last ten years, had been retrograde. If they went on as they were now doing, they would soon find themselves without any reserve at all.

The Chairman, in replying, said Dr. Mulvany had given them a pessimistic view of their affairs; but he did not think he was justified in doing so. It was true that they had paid 6 per cent.; but for years they did not pay anything at all. Therefore they had improved upon that state of things. The reduction in the price of gas had considerably affected the revenue; but if they had not made this concession, they might have suffered even more than they had done. The reduction would no doubt ultimately lead to increased prosperity.

The motion was unanimously carried, and the dividend declared.

The Chairman proposed a vote of thanks to the officers and staff at home and abroad for their services.

Mr. Morton, in seconding, remarked that anyone who had any knowledge of what had transpired in Monte Video must know that their officers had had a warm time there during the past year; and it was only by close attention that they were able to do anything in the way of securing new consumers. For many months it was really impossible for them to do so—in fact, it was a difficult task to keep the old consumers. Things, however, had got into a more settled condition. If the policy of cheap gas had been adopted years before, the Company would have been in a stronger position now.

The motion was unanimously agreed to, the vote being acknowledged by the Secretary.

On the proposition of Dr. Mulvany, a similar compliment was paid to the Chairman and Directors.

Increased Storage at the Bridlington Gas-Works.—The new 100-feet diameter gasholder designed by Messrs. T. Newbigging and Son for the Bridlington Gas Company was brought into successful operation on Wednesday last. Messrs. Clayton, Son, and Co., Limited, of Leeds, were the contractors for the ironwork; and Mr. Enoch Tempest, of Marple, constructed the tank. Mr. J. C. Archer, the Secretary of the Company, and Mr. William Newbigging, were present during the initial filling of the holder with gas.

THE GAS UNDERTAKINGS OF NEW ZEALAND.

In the course of the notice which appeared in the "JOURNAL" for the 10th inst. of the proceedings on the occasion of the first distribution of bonuses under the profit-sharing scheme introduced by Messrs. Richmond and Co., Limited, it was mentioned that one of the visitors invited by the firm to participate in that pleasant function was Mr. John Holmes, who, as the Special Commissioner of the New Zealand Government, is on a visit to this country for the purpose primarily of reporting upon the hemp and fibre industry, but also of investigating commercial questions generally. Since his arrival some few months ago, he has not only learnt a good deal about us, but has imparted, through the Press, a considerable amount of information in regard to his own colony. Knowing the readiness with which Mr. Holmes has answered questions upon the various subjects with which he is conversant, a representative of the "JOURNAL" called upon him, at the offices of the Agent-General for New Zealand (the Hon. W. Pember Reeves), a few days ago, with the view of getting some particulars in regard to the gas undertakings of New Zealand. As the result of a pleasant interview, we are able to lay before our readers the following statistics.

In April, 1896—the latest date for which official figures are available—there were nine provincial districts supplied by gas from 27 works: Auckland, Canterbury, Hawke's Bay, Marlborough, Nelson, Otago, Taranaki, Wellington, and Westland. At the above-mentioned date, the approximate value of these undertakings was £645,641, as compared with £619,163 in 1890. The former total was made up as follows: Land, £5936; buildings, £24,750; machinery and plant, £164,926. The total value of the products in the year 1895 was £199,025, against £178,947 in 1890. This improvement was secured notwithstanding that the value of the materials used was reduced from £66,363 in the latter, to £64,330 in the former year. The number of hands employed was 295—two being females; and the wages paid were £37,747 and £102. The total quantity of gas made was 532,060,300 cubic feet, as compared with 426,602,764 cubic feet in 1890; the value being £178,196, against £159,838. With regard to residual products, 17,339 tons of coke, and 345,632 gallons of tar were produced; their value being put at £14,446 and £4649. In 1860, the production of coke was 18,758 tons, and of tar 409,554 gallons; their value being £13,569 and £5420.

Taking the districts separately, in the Auckland district there were, in April, 1896, five works employing 99 hands, who received £9070 in wages. They dealt with material valued at £16,466, and produced 149,778,900 cubic feet of gas, 7150 tons of coke, and 128,200 gallons of tar—the value of these products being: Gas, £38,621; coke, £5381; tar, £1674. As the sale of other residuals brought in £110, the total value of the products was £45,786. In earning this amount, plant worth £196,810 was employed. In the group of districts comprising Hawke's Bay, Taranaki, and Wellington, there were seven works employing 79 hands; their wages amounting to £11,137. They dealt with material worth £16,187, by the aid of plant valued at £127,015; and the result was the production of 151,184,000 cubic feet of gas, 5697 tons of coke, and 81,230 gallons of tar, the values of which were respectively £50,421, £4635, and £1182—the total value of all the products being £56,258. The group of districts comprising Marlborough, Nelson, and Westland contains five works, employing 20 hands, to whom a sum of £3084 was paid. They produced from material valued at £3683, and plant worth £51,053, 36,086,600 cubic feet of gas, 1520 tons of coke, and 21,100 gallons of tar, worth respectively £14,482, £1440, and £289—the total value of the products being £16,575. The figures for the two remaining districts may be put shortly, as follows: Canterbury—Number of works, 4; hands employed, 34; wages paid, £5107; value of materials used, £12,369; value of gas (89,031,200 cubic feet), £40,898; value of coke (240 tons), £295; value of tar (14,696 gallons), £336—total, £41,529; value of machinery and plant, £105,837. Otago—Number of works, 6; hands employed (including two females), 63; wages paid, £9451; value of materials used, £15,625; value of gas (105,980,200 cubic feet), £33,774; value of coke (2732 tons), £2695; value of tar (100,406 gallons), £1168; value of other residuals, £1240—total, £38,877; value of machinery and plant, £164,926. Steam is used in nineteen works, in one of which (in Otago) water power is also employed; and in the remaining eight gas is utilized for furnishing the necessary motive force.

With regard to labour in New Zealand, the wages of artisans range from 6s. to 13s. per day; general labourers getting from 4s. to 8s. In 1894, an estimate was made of the cost of living in the colony; and it showed a total expenditure of £23,349,623. This sum included, besides what was spent on necessaries, the additional outlay on luxuries and on things of occasional necessity; and it worked out to £35 6s. 1d. per head of the population. The average earnings in the previous year (1893) were £92 12s. by the males and £33 18s. for the females. As to the prices of commodities, averages taken out for the years 1864, 1874, 1884, and 1894 indicate a decline with the advance of time.

ELECTRIC LIGHTING NOTES.

Last Thursday, the Clerk to the Hampstead Vestry (Mr. A. P. Johnson) reported that the profits on the electric light undertaking for last year had exceeded all expectations; the revenue for the year amounting to £8081. They had paid £2980 interest; repaid £1187 instalments of capital; and the net profit was £3905. Sir H. Harben, the Chairman, pointed out that, if the Vestry were a trading corporation, and had not to repay the capital by instalments, the profits for the year to rank as dividends would exceed £5000. The total amount of capital expended up to the present is £100,167.

Up to the end of last year, the Reading Electric Supply Company, Limited, had spent £42,412 on their works; and their revenue for the twelve months was £3217. As their expenditure was £3277, there was an adverse balance of £60. If, however, they followed the practice adopted in some quarters of not writing off anything for depreciation, the expenses would have been lower by £471. The £60 above mentioned added to the adverse balance of £76 brought forward from 1896, and a net sum of £628 paid for debenture interest, made a total debit balance of £764. However, the Directors, in the report presented to the shareholders at their recent meeting, said they were not surprised at this result, as, notwithstanding that the income of the Company for current last year showed an increase of 50 per cent. on that for the preceding twelve months, the charge in respect of debenture interest, together with a considerably increased expenditure for coal, wages, &c., consequent upon the extended hours of service resulting from the adoption of the continuous supply of current, was sufficient to account for the position. The Directors look forward to a considerable accession of business in connection with private house lighting as the result of the change. Additional plant will be required; but as there is only a balance of £1637 of unexpended capital, the Board are considering the best mode of raising more money.

One more stage has been reached by the Corporation of Sheffield in their progress towards the acquisition of the electric light undertaking; a poll of the ratepayers taken last Tuesday having sanctioned the purchase by a very large majority. The circumstances under which the poll was necessitated were peculiar. It may be remembered that the terms of purchase had been agreed upon between the Corporation and the Electric Light Company. A Bill was promoted to authorize the purchase; and the formality of obtaining the approval of the ratepayers was observed. The meeting was regarded as of so routine a character that no effort was made by the Corporation to secure an attendance. To their astonishment, some fifty or sixty people who were interested in the installation of the electric light for private consumers presented themselves at the meeting, and endeavoured to obtain from the Lord Mayor a promise that the Corporation, when they came into possession of the works, would not continue the wiring business of the Company, and so come into competition with them. His Lordship said the matter had not been considered by the Corporation; and he declined to give any such pledge. Thereupon the people interested in this trade voted against the proposal to purchase, and defeated it. This necessitated the taking of a poll, and putting the city to an expense of something like £1000. The result of the poll was that 28,130 of the ratepayers voted for, and 1965 against the purchase—a majority of about 93 per cent. The importance attached to the question in the eyes of some of the burgesses may be gauged by the fact that 68,000 people were entitled to vote; and the papers returned numbered 45,555, of which 17,654 had never been filled up. About a similar number were not sent in at all.

The proposed transfer of the business of the Birmingham Electric Supply Company to the Corporation has advanced an important step nearer to realization. Last Wednesday, a special meeting of the General Purposes Committee of the City Council was held, under the presidency of the Lord Mayor, to consider the Sub-Committee's report on the subject of the purchase. This embodied the result of the investigation as to the position and capabilities of the works of the Company, which had been made by Mr. Graham Harris, of the firm of Messrs. Bramwell and Harris, of London, and it would appear to have been so far satisfactory as to commend the idea of purchase. After fully discussing the report presented to them, the General Purposes Committee determined to recommend the purchase of the Company's business to the City Council; the suggested terms of transfer, reckoned on the basis of the Stock Exchange quotations, being £10 10s. per £5 share. The works which it is proposed to purchase include the Company's generating stations and offices in Dale End, and the depots at Water Street and Ladywood, the last-named property being held on a 96 years' lease, while the others are freehold. The Birmingham Electric Supply Company carry on operations under Orders obtained in 1888 (amended in 1891) and in 1894. The former Order covers the central business area of the city, and gives a concession for 42 years, dating from August, 1889; the latter includes the jewellery district and Edgbaston. The authorized capital of the Company is £200,000, in £5 shares, fully paid up. As indicating the position of the Company, it may be mentioned that the balance of profit from the last year's working was £13,656, and after applying £4460 to the credit of the depreciation reserve fund, a dividend of 5 per cent. was paid—absorbing £8206, and leaving £989 to be carried forward. The Directors were authorized, at the annual meeting in March, to increase the capital to £300,000 by the creation of 20,000 additional ordinary shares of £5 each; but pending the negotiations then proceeding with the Corporation, it was understood that no steps would be taken in the matter. The gradual increase in the Company's operations is emphasized by a reference to the current supplied during the last three years, and to the number of units sold. At the close of 1895, the Company were furnishing current equivalent to 18,199 lamps of 16-candle power; at the end of 1896 the figure increased to 25,876 lamps; and at the end of 1897, to 39,232 lamps. In 1895, the Company sold 490,000 units; in 1896, a little over 756,000 units; and in 1897, more than 1,133,000 units. The suggestion made in May last, as to the transfer of the Company's business to the Corporation, has had the effect of enhancing the value of the shares.

The London County Council and the Water Commission.—At the meeting of the London County Council last Tuesday, the Water Committee's report, referred to in the article on "Water and Sanitary Affairs" last week, in which they recommended that the Standing Orders should be suspended so far as they would affect proposals for legislation during the Session of 1899 dealing with the Metropolitan Water Supply, and that the Committee should be authorized, if they deemed it desirable, to recommend application to Parliament on this subject at any time not later than Nov. 15, 1898, was presented and unanimously adopted.

Sales of Shares.—Last Tuesday, Mr. W. E. R. Randall sold by auction, at Chatham, 70 fully-paid £5 shares in the Brompton, Chatham, and Gillingham Water Company, at £16 5s. and £16 6s. each. In the Burgh Court Hall at Airdrie, on the same day, Mr. A. Morrison offered for sale 1000 new ordinary £10 shares in the Airdrie and Coatbridge Water Company, authorized by their 1892 Act. The shares were put up in lots of 20 at £11 per share, and realized from £13 15s. to £14 per share; the average price being £13 16s. 11d. Two lots of Airdrie Gaslight Company's £10 shares were afterwards offered, and realized from £18 to £18 10s. per share. At the Lion Hotel, Worksop, on the following day, Mr. F. Bannister sold by auction five £10 8 per cent. shares, five £5 7 per cent. shares, eight £5 6 per cent. shares, and eight £1 13s. 4d. 5 per cent. preference shares in the Worksop Gas Company, with the accruing dividend thereon from Dec. 31, 1897. The first lot was bought at the rate of £20 per share; the second, at £7 15s. per share; the third and fourth lots at £7 and £2 per share respectively. On the 19th inst., 120 £10 preference shares in the Paignton Gas Company were sold at par.

METROPOLITAN WATER SUPPLY COMMISSION.

Twenty-third Day—Monday, May 23.

(*Viscount* LLANDAFF, *Chairman*, *Sir* G. B. BRUCE, M.Inst.C.E., *Major-General* A. DE COURCY SCOTT, R.E., *Rt. Hon.* J. W. MELLOR, Q.C., M.P., *Mr.* A. DE BOCK PORTER, C.B., *and Mr.* R. LEWIS.)

The sitting took place at the Westminster Town Hall.

The following Counsel are engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River Company; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord R. CECIL for the Hertfordshire County Council; Sir JOSEPH LEESE, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London. The Southwark and Vauxhall Water Company are represented by Messrs. BIRCHAM AND Co.

Sir *Alexander Binnie*, who was under examination when the Commission adjourned, was further questioned by Major-General SCOTT. He handed in tables in continuation of his evidence last week. He first gave the cost of obtaining from the Thames by the Staines scheme 114½ million gallons of water; being the difference between the total 300 million gallons of the Staines scheme and the 195½ million gallons already authorized to be taken by the Companies from the Thames to date. This figure was £10,703,570; being the difference between his estimates of £18,039,945 and £7,336,375 as the cost of obtaining 300 and 185½ million gallons respectively, and allowing in each case a minimum flow at Teddington of 250 million gallons. With a minimum flow of 200 million gallons at Teddington, the cost of 300 million gallons would be £15,589,990; and of 185½ million gallons, £4,705,185. So that the cost of the 114½ million gallons on the basis of the reduced flow, would be £10,884,805. For the purpose of forming a comparison between the Staines scheme and the Welsh gravitation project, nothing was included for distributing mains and pipes or for filters, which, he assumed, would be common to any scheme of extension; nor for law, parliamentary, or engineering charges. Another table showed the cost of obtaining by the Welsh gravitation scheme 114½ million gallons daily. The figure was £10,032,250—being £1,850,000 for the Yrfon reservoir and head works; £6,867,500 for the aqueduct, 162 miles in length, composed of 117 miles of covered conduit and tunnel to carry 200 million gallons a day, and 45 miles of pipe to carry 114½ million gallons a day; and £1,314,750 for terminal works at Elstree, sufficient for 114½ million gallons a day, exclusive of filters. This estimate was equivalent to the total which was given by Mr. Deacon as £9,848,000. Mr. Deacon, however, made a proportionate reduction in the cost of the masonry and tunnel portion of the conduit, to reduce it to the flow of 133⅓ million gallons a day; whereas witness preferred to make these portions of the full size to take 200 million gallons a day in the first instance—his calculations being based on the assumption that the Welsh project would be carried out in instalments as necessity might require. He also produced an estimate of the cost of bringing from Wales 147 million gallons of water a day. This had relation to the Yrfon yield of 121 million gallons a day, and to the Towy yield of 44 million gallons. He allowed £2,190,000 for reservoirs and head works at Yrfon and Towy; £7,760,000 for the aqueduct, 162 miles in length, composed of 117 miles of covered conduit and tunnel, and 45 miles of pipe, the whole to convey 200 million gallons a day; £1,911,000 for terminal works at Elstree; and £1,653,750 for filters—making a total for works of £13,514,750, or, *plus* law and parliamentary charges £597,250, £14,112,000. This estimate, witness pointed out, should not be compared with those he gave at the last sitting for obtaining further supplies from the Thames, because the Thames could not be made to yield, at any reasonable cost, 147 million gallons a day in addition to the 185½ million gallons already sanctioned; and, further, those estimates included nothing for filters. In another table, he showed the additional charges necessary to increase the supply from Wales from 147 million gallons to 200 million gallons a day. Llangurig reservoir would yield 43 million gallons daily, which, added to the 165 million gallons in the previous instalment, would increase the total to 208 million gallons. The cost of Llangurig reservoir and head-works would be £650,000; of the conduit from Llangurig to Yrfon, £227,000; and of the further necessary head works and filters at Elstree, £1,286,000—a total of £2,213,000, or, *plus* additional law and parliamentary charges £221,000, £2,434,000. Adding the former estimate for the cost of 147 million gallons, £14,112,000, brought out the final figure of £16,546,000. For the same reason as in the case of the preceding table, this estimate could not be compared with that for obtaining supplies from the Thames. In his previous estimates, he had always allowed for a capacity of 866 million gallons in respect of reservoirs already in existence, and also for the fact that a considerable quantity of water from the Thames was taken direct, without going to a reservoir, to the filtering works of the Companies. He had gone into the question—the most difficult of the whole of the Staines scheme—of the occasions when the river water would have to be shut out and the Companies confined to the use of the water in their reservoirs. He had the figures of each of the days in 1893 when the Chelsea Company acted in this way; and of those days, the one on which the flow was lowest, was Oct. 10, when the natural flow over Teddington Weir was 772·9 million gallons. This was the day on which, in the opinion of the Company, the river was much too muddy and polluted for the water to be taken direct to the filter-beds. Witness put in a table showing that in 1893 the Chelsea Company found it necessary to close their intakes on 44 days on account of the badness of the river water; the number of days in 1896 being 38. He could not say whether the other Companies were taking water when the Chelsea Company—who he admitted had powers of abstraction greater than their needs—were not. The ability to discard the water, depended very much on the storage capacity of each Company.

Major-General SCOTT: Do you think the whole of the water taken from the river by the Staines scheme could be dealt with directly by filtration?

Witness: That is somewhat difficult to answer, in view of what has transpired recently. I am very much troubled by this question. During the years 1896 and 1897, Dr. Frankland made 199 examinations of the filtered water, for the purpose of ascertaining the number of bacteria. They varied from 16,000 per cubic centimetre down to nothing. There were 55 days out of the 199 on which the number of microbes per cubic centimetre exceeded 100.

In reply to Sir G. BRUCE, Major-General Scott said Dr. Frankland adopted 100 microbes per cubic centimetre as an arbitrary standard; but it had never been officially sanctioned.

Major-General SCOTT (to witness): I wish to take you very shortly through this, because what appears to be the material matter before us is the question whether there is any necessity for doing something special with the portion of the water which is taken under the Staines scheme directly from the river, and whether the special arrangement (whatever it may be) would add to the cost of the estimate which you presented on the last occasion, and which depends in the main on the quantity of reservoir capacity which is required?

Witness: On the 55 days when Sir Edward Frankland's examination shows that the number of microbes exceeded the standard 100, I find that they averaged 763 microbes per cubic centimetre. That is a very large proportion. Out of the total number of examinations which he made it is 28 per cent.; so that we are dealing with what I always felt to be a difficult part of the Staines scheme. We are dealing with a river the flow of which undoubtedly comes from a populous district, and is liable to contamination. This contamination is shown not only in the river, but in the actual water after filtration. I myself look upon the microbes shown as a very important indication—not in the sense of the microbes themselves, but as indicating that the microbes are there. The presence of the microbes proves the decomposition of some organic matter; and when you find that the filters become infected, it is a very serious matter for consideration.

Without going deeply into these questions—they are very difficult questions, and many of them quite undecided—I wish in a general way to gather from you whether you think that the estimate you presented on the last occasion needs some addition in respect of special treatment of water derived from the river under the Staines scheme?—I do not think it is absolutely necessary to increase the storage capacity; but when the river water from any cause is considered suspicious, in my opinion it should be passed through the large storage reservoirs—it should not be pumped directly from the river to the filters. This would mean an alteration as regards the cost of pumping from the river into the reservoirs. The engines would not need to be more powerful; but they would have to be used more often.

Then we may take it that some small addition to the expenses of the scheme for 185½ million gallons might probably be necessary?—In all probability it would; but I am unable to state what amount.

The CHAIRMAN pointed out that witness's estimate for providing 300 million gallons a day, with a minimum flow of 200 million gallons over Teddington Weir, was £15,589,000, against a figure (apparently for the same thing) given by Mr. Deacon of £8,440,000.

Witness stated that the difference was probably accounted for by the fact that Mr. Deacon's estimate did not include the cost of pumping from Staines into the districts of the Companies.

Sir G. BRUCE questioned witness somewhat closely as to what bearing the evidence he was giving had on the desirability of purchase—the chief point in the reference to the Commission. Witness said he was in favour of purchase; and the conclusion to be drawn from his evidence was that, whether the undertakings remained in the hands of the Companies or were transferred to some public body, the authority or bodies would be driven outside the Thames Valley for a further supply. This intensified the need for purchase, because, if this conclusion were accepted, he held that it would be better the work should be under one control rather than in the hands of eight Companies, and subject to differences of opinion.

By the CHAIRMAN: After the purchase of the Companies, he thought there would have to be a further expenditure, commencing at once, of £7,300,000 to complete the Staines scheme, and of £14,112,000 for fetching a further supply from outside the Thames basin.

The CHAIRMAN: I must say this seems to tend against the expediency of purchase, inasmuch as it is an immediate burden of £21,000,000 odd which you would advise the purchaser to incur, in addition to the cost of the Companies?

Witness: Both would have to do it. If the Companies were left as they are now, they would have to incur the expenditure, and the burden would fall on the consumers just the same as on the public body.

Major-General SCOTT: If we take your estimate for the cost of obtaining 185½ million gallons at £7,336,375, we shall see that a large proportion arises from the fact that you wish to place under the conditions of the Staines scheme the whole of the water which the Companies are now allowed to take without any conditions out of the Thames, amounting to 130 million gallons?

Witness: That is how I read the report of the Balfour Commission.

So that if you were before an arbitrator, I take it the County Council would argue that the works of the Companies for dealing with 130 million gallons now are not in a proper condition; that they should construct reservoirs to enable them to take the water under the same restrictions as in the Staines scheme; and that, if they do not, the works are not to be considered in a proper condition, and a deduction should be made on that account?—Certainly.

Taking the other side, assume that the Companies urge before the arbitrator that they have the statutory privilege of taking the water without any of those conditions, by means of their present works. If they established this, the result would be that the Council would purchase the undertakings paying for the privileges of the Companies of taking 130 million gallons without any conditions, and then proceed to demolish those privileges and put up works costing perhaps between £4,000,000 and £5,000,000, in order to bring the supply under the conditions which you consider would be essential?—Clearly that would be so.

Sir G. BRUCE: You have said a good deal about microbes. I have the report of the Water Examiner for the month of March. He says the 189 samples taken were all bright, clear, and well filtered; and lower down he speaks of the purity of the supply of London. Of course, you are aware that we all have microbes in our mouths and saliva; and that the Atlantic would be a ditch but for them?

Witness: All I say is Dr. Frankland, the adviser to the Local Government Board, has placed the standard at 100 per cubic centimetre.

Witness was then subjected to a long cross-examination by Mr. PEMBER, with the object of foreshadowing the evidence which the Companies would have to lay before the Commission. He said it was not stated in the Balfour report that no more than 300 million gallons of water daily could be obtained from the Thames; but it was patent that this would so nearly exhaust the quantity available from this source, that they could not take much more. To get the difference between 185 and 300 million gallons daily from the Thames, storage for 28,000 million gallons would be needed, of which 8000 million gallons represented the quantity that would have to be allowed for reservoirs emptied to be cleaned, or in which the water would be drawn off on account of its impure condition, or for loss by evaporation. He agreed that if this figure were enormously overestimated, a considerable reduction would follow in the estimate for the completion of the Staines scheme. In the same way, it was suggested to witness that he had made excessive allowances in respect of other factors in the scheme; and, while adhering in the main to his estimates, he agreed that if this were so his figures of the cost would have to be further reduced.

Mr. PEMBER: With regard to the working of the reservoirs at Staines, have you considered that the Companies would draw down one right away at once; then go to the second; then to the third; then to the fourth; and so on? Do you not think that if they got their reservoirs filled, they would draw down one to a certain depth, as the stuff in it was gradually subsiding; then leave it to allow of a little more subsidence; then go to a second and draw it down similarly to a certain point; leaving this once more to subside; and so on with the others?

Witness: It is possible to do it in this way; but that is not how I should do it, because I think I could produce a better and more economical result working by another mode.

At all events, that would give the impurities more time, and a better chance of going right down to the bottom, than if the reservoir were drawn down suddenly and at once?—Yes; but I should not propose to do it. Assuming that we have eight or any larger number of reservoirs, I should pass the water from one into the other and so on, in series to the last one, which would contain the purest water. By this means, I think you would get a better result. I have had a good deal of experience in the sedimentation of dirty water; and that is the most economical way in the end. However small the film of mud at the bottom, it would not do to leave it there.

Further cross-examined, witness declined to go into a case which was mentioned to him, of the Grand Junction Company having recently run off a reservoir that had not been cleaned for eighteen years, and which, it was found, had only six inches of mud at the bottom. As to the size of the reservoirs, witness had put them at 2 million gallons each; but he admitted it might be cheaper to construct a fewer number of greater capacity. Another item on which the Companies were at serious issue with witness's figures was that for pumping 170 million gallons a day, at £2 10s. per million gallons, which equalled £155,125, or capitalized at thirty years, £4,653,000. Counsel asserted that this item would commence at *nil* and increase gradually, so that it should not be capitalized at all. Adding the cost year by year, they made the figure £883,000, as against the £4,653,000. Witness replied that, within very narrow limits, the figures he had taken were those of Messrs. Hunter and Fraser. He had charged against the Staines scheme what he considered would be the saving of pumping by the introduction of Welsh water. As a matter of fact, however, some portion of the Welsh water would have to be pumped. He should hardly say it would be a sixth.

In reply to the CHAIRMAN, Mr. Pember said the Companies' estimate of the cost of completing the Staines scheme—or rather of getting the difference between 185 and 309 million gallons—was £4,900,000.

Mr. PEMBER: On the assumption that there is water to be obtained from the Thames, what reason is there why, when we have gone up to this 309 million gallons a day, we should not go on, add a couple more reservoirs of, say, 3600 million gallons, and get some 40 million gallons a day more?

Witness: From the figures I have placed before the Commission, I show that, taking the average of four years—1885, 1887, 1893, and 1896—the average natural flow of the river for 149 days was only 418 million gallons a day; and under these circumstances an increase of only 50 million gallons to meet my 250, necessitated an increased storage of from 28 to 38 million gallons. When you contemplate taking 185 or 300 million gallons from the river, you are approaching very rapidly the point of exhaustion, without you take in the large floods in the winter months.

You say 10,000 million gallons fresh storage would add 50 million gallons a day?—Yes.

That is pretty much what I say. Supposing we did this, and then obtained 350 million gallons from the Thames, and afterwards added this to the 120 million gallons which are to be got from the Lea and wells, that would give 470 million gallons, which, at 35 gallons per head, would be enough for 13,400,000 people?—Of course, you are at liberty to prove that; but I cannot assent to it.

Witness was then questioned regarding details of his Welsh scheme, the figure per million gallons of which (£96,000) he thought compared very well with the Manchester and Birmingham schemes.

Cross-examined by Mr. RICKARDS: The Chelsea Company only took an average draft of 12,283,000 gallons daily from the river, though their authorized quantity was 22 million gallons. He knew that the Company had power to sell to other Companies the difference between their authorized draft and the actual consumption; and that arrangements had been made between the Engineers of the Companies by which connections were to be made for this power to be put in operation.

Witness was then examined by the CHAIRMAN regarding the partition of works both for the supply and distribution of water between London, if it became the purchaser of the Companies, and the county of Surrey. The total supply of the Lambeth and Southwark Companies in 1896 was about 56¼ million gallons daily, 49 million gallons of which were delivered in London, and 7½ million gallons in Surrey. Some small portions were also supplied by the Kent Company. Of the quantity delivered in Surrey, about 1 million gallons was taken by Croydon; leaving about 6½ million

GAS AND WATER COMPANIES STOCK AND SHARE LIST.

Referred to on p. 1246.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 15	10½	Alliance & Dublin 10 p. c.	23¾—24½	..	4 5 9
100,000	10	„	7½	Do. 7 p. c.	16—17	..	4 8 3
300,000	100	Jan. 3	5	Australian 5 p. c. Db. .	106—108	+1	4 12 7
200,000	5	May 26	6	Bombay, Ltd.	5½—6*	..	5 0 0
40,000	5	„	6	Do. New, £4 paid .	4¾—5*	..	4 16 0
380,000	Stk.	Feb. 24	12	Brentford Consolidated	290—295	..	4 1 4
240,000	„	„	9	Do. New . . .	215—220	..	4 1 10
50,000	„	„	5	Do. 5 p. c. Prf.. .	140—145	..	3 9 0
159,375	„	Dec. 15	4	Do. 4 p. c. Db. Stk.	134—138	..	2 18 0
220,000	Stk.	Mar. 30	11½	Brighton & Hove Orig. .	270—275	..	4 3 8
218,820	„	„	8½	Do. A. Ord. Stk. .	195—200	..	4 5 0
933,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max. .	127—132	..	3 15 9
420,000	20	Ma . 30	11½	British	55—56	..	4 0 4
50,000	10	Mar. 11	11½	Bromley, Ord. 10 p. c. .	25—27	..	4 5 2
75,000	10	„	8½	Do. 7 p. c. .	20—22	..	3 17 3
500,000	10	Apl. 29	6	Buenos Ayres (New) Ltd	8½—9½	..	6 9 9
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
150,000	20	Mar. 11	8½	Cagliari, Ltd. . . .	30½—31½	..	5 4 9
100,000	10	Sep. 30	8	Cape Town & Dis., Ltd.	15—16	−1	5 0 0
50,000	50	May 3	6	Do. 6 p. c. 1st Mort.	58—60	..	5 0 0
550,000	Stk.	Apl 15	13½	Commercial Old Stock .	322—327	−1	4 2 7
200,750	„	„	10½	Do. New do. . .	250—255	..	4 2 4
200,750	„	Dec. 15	4½	Do. 4½ p. c. Db. dc.	150—155	..	2 18 1
800,000	Stk.	Dec. 15	12	Continental Union, Ltd.	210—220	..	5 9 1
200,000	„	„	9	Do. 7 p. c. Prf. .	195—205	..	4 7 10
51,600	Stk	Feb. 24	14	Croydon A 10 p. c. . .	310—315	..	4 8 11
168,400	„	„	11	Do. B 7 p. c. . .	255—265	..	4 3 0
535,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p c.	125—130	−3	4 0 9
60,000	„	„	5	Do. 5 p. c. Prf. .	142—145	..	3 9 0
486,090	10	Jan. 27	11	European, Ltd. . . .	23¾—24½	..	4 9 9
354,060	10	„	11	Do. £7 10s. paid .	17—18	..	4 11 9
5,922,110	Stk.	Feb. 10	12½	Gaslight & Coke, A, Ord.	292—297	..	4 5 9
100,000	„	„	4	Do. B, 4 p. c. max. .	118—123	..	3 5 1
665,000	„	„	10	Do. C, D, E, 10 p. c. Prf.	300—305	..	3 5 7
30,000	„	„	5	Do. F, 5 p. c. Prf. .	150—155	..	3 4 6
60,000	„	„	7½	Do. G, 7½ p. c. do. .	220—225	..	3 6 8
1,300,000	„	„	7	Do. H, 7 p .c. max. .	195—200	..	3 10 0
463,000	„	„	10	Do. J, 10 p. c. Prf. .	300—305	..	3 5 7
476,000	„	„	6	Do. K, 6 p. c. Prf. .	178—183	..	3 5 7
1,061,150	„	Dec. 15	4	Do. 4 p. c. Db. Stk. .	132—135	..	2 19 3
294,850	„	„	4½	Do. 4½ p. c. do. .	150—155	..	2 18 1
958,000	„	„	6	Do. 6 p. c. do. .	200—205	..	2 18 6
70,000	10	May 12	8	Hongkong & China, Ltd.	13¾—14½	..	5 10 4
3,800,000	Stk.	„	10	Imperial Continental .	210—215	+3	4 13 0
376,400	100	Feb. 1	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Db. Stk. „	103—106	..	3 6 0
560,000	100	Apl. 1	5	Met. of Mel-bourne } 5 p. c. Db.	110—112	..	4 9 3
250,000	100	„	4½	} 4½ p. c. Db.	107—109	..	4 2 7
					* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Dec. 15	6	Malta & Medn., Ltd. .	5½—5¾	..	5 4 4
541,920	20	Nov. 11	5	Monte Video, Ltd. . .	14½—15½	..	6 9 0
617,946	Stk.	Feb. 24	9¾	Newc'tle & Gatesh'd Con.	235—240	..	4 1 3
252,355	Stk.	Jan. 3	3½	Do. 3½ p. c. Db. Stk.	115—120	..	2 18 4
150,000	5	May 26	8	Oriental, Ltd. . . .	7¾—8¼*	..	4 16 11
135,000	5	„	8	Do. New, £4 10s. pd.	6¾—7¼*	..	4 19 4
15,000	5	„	8	Do. do. 1879, £1 pd.	1—2*	..	4 0 0
60,000	5	Mar. 11	7	Ottoman, Ltd.	4¾—5½	..	6 13 4
500,000	100	Dec. 1	6	People's Gas } 2nd M. of Chicago } Bd. .	105—110	+2	5 9 1
848,070	10	May 26	6	River Plate Ord.. . .	9—9¼*	..	6 6 4
250,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
250,000	10	Apl. 29	10	San Paulo, Ltd. . . .	15—16	..	6 5 0
135,000	Stk.	Mar. 30	10	Sheffield A.	24⅝—248	..	4 0 8
209,053	„	„	10	Do. B.	245—248	..	4 0 8
447,427	„	„	10	Do. C.	245—248	..	4 0 8
5,531,250	Stk.	Feb. 24	5½	South Metrop., 4 p.c Ord	135—138	..	3 16 1
1,460,000	„	Jan. 13	3	Do. 3 p. c. Db. Stk. .	100—103	−3	2 18 4
60,000	Stk.	Mar. 11	12	Tottenham and } A. . Edmonton } B. .	285—295	..	4 1 4
60,000	„	„	9		205—215	..	4 3 9
182,380	10	Dec. 30	7	Tuscan, Ltd.	13—14	..	5 0 0
149,900	10	Jan. 3	5	Do. 5 p. c. Dbs. Red. .	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	320—330	..	3 3 8
150,000	„	„	5	Do. 5 p. c. Prf. . . .	170—175	..	2 17 2
160,000	„	„	4½	Do. 4½ p.c. Pf. Stk., 1875	150—155	..	2 18 1
175,785	„	Mar. 30	4½	Do. 4½ p. c. Db. Stk. .	157—162	−1	2 15 7
1,720,560	Stk.	Apl. 15	8	East London, Ord. . .	225—230	..	3 9 7
654,740	„	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	158—162	..	2 15 7
390,000	„	„	3	Do. 3 p. c. Db. Stk..	104—106	..	2 16 7
700,000	50	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	115—120	..	3 2 6
310,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140—145	..	2 15 2
708,000	Stk.	Feb. 10	13	Kent	358—363	..	3 11 8
160,000	„	„	7	Do. New, 7 p. c. max..	213—218	..	3 4 3
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max. .	295—300	..	3 6 8
406,200	100	„	7½	Do. 7½ p. c. max. .	228—233	..	3 4 4
350,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140—145	..	2 15 2
500,000	100	Feb. 10	13	New River, New Shares	430—435	−5	2 19 9
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	142—147	..	2 14 5
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	155—160	..	3 15 0
126,500	100	„	6	Do. do. 7½ p. c. max. .	152—157	..	3 16 5
489,200	Stk.	„	5	Do. do. 5 p. c. Prf. .	170—175	..	2 17 2
1,019,585	„	Apl. 15	4	Do. 4 p. c. A Db. Stk.	140—143	..	2 15 11
1,155,066	Stk.	Dec. 15	10	West Middlesex . . .	300—305	..	3 5 7
200,000	„	„	4½	Do. 4½ p. c. Db. Stk.	160—165	..	2 14 7
200,000	„	Mar. 11	3	Do. 3 p. c. Db. Stk.	104—106	−1	2 16 7
					* Ex div.		

gallons to be supplied to Surrey alone. Under an agreement which the County Council prepared with Surrey, the 1 million gallons was to be abandoned, and a portion of the supplying and distributing pipes sold to Croydon. Also it was agreed that Surrey should receive its present water supply—namely, 6½ million gallons a day, *plus* 20 per cent., or 1½ million gallons, for immediate increase—a total of, say, 8 million gallons a day, or 14 per cent. of the total present supply of the two Companies. The mains passing through the County of Surrey on the way to London were: The Southwark and Vauxhall Company, one 42-inch, one 36-inch, one 30-inch, and one 12-inch, in addition to which there was a 12-inch main to supply Wimbledon within the County of London; the Lambeth Company, three 30-inch mains, besides two 12-inch ones to supply the Coombe reservoir; and the Chelsea Company, one 30-inch main from Seething Wells to Putney Heath, one of 30 inches decreasing to 24 inches, and one of 15 inches. The Chelsea Company, however, did not supply in Surrey. There existed, coming from Molesey, a 36-inch pipe, and a conduit of 5 ft. 9 in. by 4 ft. 9 in., which ran to Seething Wells. Either might be handed over to Surrey, leaving in the hands of London all the Chelsea and Southwark Companies' pipes. The total pumping power of these Companies was 8240-horse power, distributed over 55 separate engines. Surrey could take the whole of the engines at Molesley. At Seething Wells, there were filters enough for 8 million gallons. Above Seething Wells, Surrey could have handed over to it three or two 12-inch mains for the Coombe reservoir, together with the pumping power at Seething Wells necessary to supply the reservoir with which to serve the Kingston rural district. Then, for the districts in the remaining portion of Surrey, one of the 30-inch mains, from Seething Wells to Brixton, with the necessary pumping power, might be made over for the supply of Surbiton, Maldon, Raynes Park, and Merton, and the outside district supplied from the Norwood and Selhurst reservoirs. Up to this point, everything would be easy; the difficult part would now arise—viz., how to supply Richmond and Barnes. This would have to be done by giving over a 12-inch main of the Southwark and Vauxhall Company which ran from Hampton by way of Teddington, Barnes, and Richmond, to Wandsworth pumping-station, together with the necessary proportion of pumping-power at Wandsworth. The horse power at Wandsworth was the one thing he did not know in connection with this matter. The difficulty was to get the high parts of Wimbledon supplied. The rising main to Wimbledon could be added to the above apportionment; and if found advisable, a connection could be made between the 12-inch main of the Southwark and Vauxhall Company which supplied the upper part of Wimbledon, and the 12-inch main of the Lambeth Company which supplied the lower part. The quantity conveyed by the 12-inch main would be about 1½ million gallons daily. A due proportion of reservoir space at Molesey and of filter-beds at Seething Wells and Hampton would also be given to Surrey. This scheme, he thought, was one which an impartial mind would accept as fair.

Major-General Scott: Assuming it was necessary to throw out of work the pipe bringing water from Molesey to Seething Wells for the purpose of cleaning, what would happen?

Witness: A new pipe would have to be laid; and this is the way I believe the Company are now dealing with the difficulty.

But I mean if you deliver over to Surrey only one pipe, and that pipe becomes choked or out of repair, unless you give something additional the whole thing would collapse?—It certainly would, if there was nothing in addition.

Witness was still under examination when the Commission adjourned for a fortnight.

THE LOCAL GOVERNMENT BOARD AND THE PROTECTION OF SOURCES OF WATER SUPPLY.

Proposed General Legislation.

Readers of the "Journal" are aware that the Local Government Board have been communicating with local authorities with the view of stimulating them to a more active supervision of the sources of the water supply of their respective districts, so as to ensure, as far as possible, their freedom from pollution. In addition to this, the Board, in their reports on the various Water Bills that were to come before Parliament this session, specially emphasized the importance of this matter, and intimated that clauses of general application were being settled for insertion in these Bills; and they have been allowed to go forward on this understanding. The clauses have now been prepared; and when the Higham and Mid-Kent Water Bills come before the House for consideration on the 10th prox., Mr. Chaplin will move their insertion. They are in the following terms:—

Penalty for Failure to Supply Pure and Wholesome Water (10 *Vic., cap.* 17).

1.—If the Company fail to provide and keep such a supply of pure and wholesome water as is required by section 35 of the Water-Works Clauses Act, 1847, they shall, unless prevented by frost, unusual drought, or other unavoidable cause or accident, be liable for the first offence to a penalty not exceeding £20, and to a penalty not exceeding £5 for every day on which the offence is continued after conviction; and such penalties may be recovered summarily before a Petty Sessional Court.

2.—Any offence under this section may be prosecuted by any Local Authority acting in the execution of the Public Health Acts in any part of whose district the Company supply water for domestic purposes, or by any person supplied by the Company with water for domestic purposes.

3.—All penalties recovered under this section shall be applied in such manner as the Court may direct.

Power to Take Samples of Water.

1.—For the better enforcement of the provisions of section 35 of the Water-Works Clauses Act, 1847, any Medical Officer of Health or other person authorized by any Local Authority acting in the execution of the Public Health Acts for any district in any part of which water is supplied by the Company for domestic purposes (producing, if required, a certificate of his personal authority signed by the Clerk to the Local Authority) shall be entitled at any time, on giving not less than six hours' notice to the Company, to take and carry away samples of water

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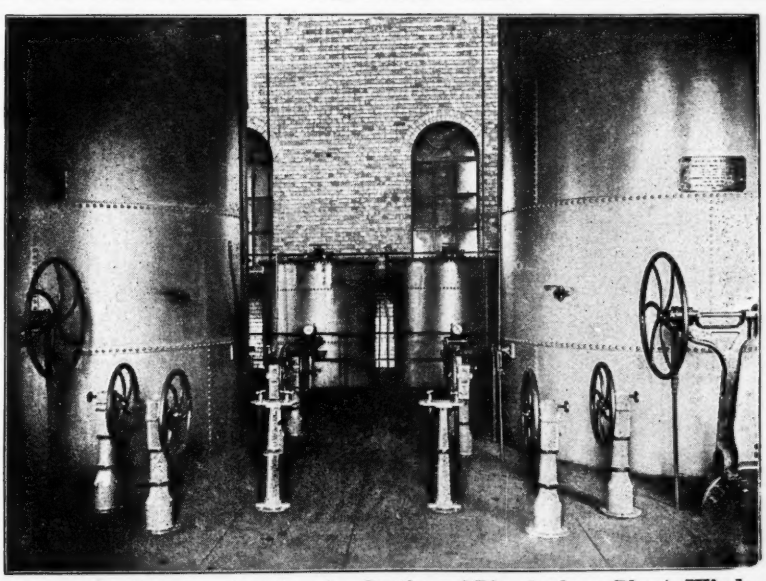

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
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from any land, reservoir, work, building, filter-bed, main, pipe, stand-pipe, or stop-cock of the Company from, through, or by which a supply of water is given, and may for that purpose enter upon any lands or premises of the Company. Any person who obstructs or molests such Medical Officer of Health or other person authorized as aforesaid shall be liable to a penalty not exceeding £20 for each such offence; and such penalty may be recovered summarily before a Petty Sessional Court.

2. Any water consumer may at any time, on giving such notice as aforesaid, take and carry away samples of water from any land, reservoir, work, building, filter-bed, main, pipe, stand-pipe, or stop-cock of the Company from, through, or by which a supply of water is given, and may for that purpose enter upon any lands or premises of the Company.

3. - Any samples shall be taken in triplicate, and shall forthwith be respectively sealed up and marked by the person taking the same, who shall leave one of such samples with the Company, or an officer or other agent of the Company, and may submit another for examination if he thinks fit, and shall retain the third for future comparison if required.

4.—The Company shall be entitled to be represented by an officer or other agent when the samples are taken, sealed up, and marked.

5.—For the purposes of this section, "water consumer" means any person who is supplied by the Company with water for domestic purposes, or who pays or is liable to pay any rate for such a supply.

Pollution of Sources of Supply.

1.—For the better discovery of any causes of pollution of the water obtained or supplied by the Company, any officer of the Company authorized in that behalf by the Company, and any Medical Officer of Health for any district whereof any part is supplied by the Company with water for domestic purposes, authorized in that behalf by the Local Authority for such district, may at any time between the hours of nine in the forenoon and four in the afternoon, on producing, if required so to do, a certificate of his personal authority signed by the Secretary of the Company in the case of an officer of the Company, or by the Clerk to the Local Authority in the case of the Medical Officer of Health, enter on any land or premises from which water is obtained or supplied, whether immediately or otherwise by the Company, and may take and carry away samples of any water or of any matter, substance, or liquid which may appear likely to cause pollution to the water of the Company, or to the sources of supply of the Company, or whereby such water may be fouled.

2.—Any samples shall be taken in triplicate, and shall forthwith be respectively sealed up and marked by the person taking the same, who shall leave one of such samples with the person having the custody of the premises, and may submit another for examination if he thinks fit, and shall retain the third for future comparison if required.

Power to Enter Lands and Premises for the Purpose of Taking Samples and Discovering Causes of Pollution.

1.—If any water consumer authorized by section 2, or any person authorized by or under section 3, to take and carry away samples or to enter on any lands or premises, is refused permission so to do, any Justice having jurisdiction in the place where the land or premises is or are situate, on complaint thereof on oath by such person (made after reasonable notice in writing of the intention to make the same has been given to the person having custody of the premises), may, on reasonable cause being shown, by order require such person to admit the person authorized as aforesaid upon the premises during the hours mentioned in the order, and to permit and to give all facilities to him to take and carry away such samples as aforesaid.

2. - Any order made under this section shall continue in force until the purposes for which such order was made are completed; and any person who refuses to obey an order so made shall be liable to a penalty not exceeding £10; and any person who obstructs or molests any person authorized to take samples shall be liable to a penalty not exceeding £5 for each such offence—such penalties to be recovered summarily before a Petty Sessional Court.

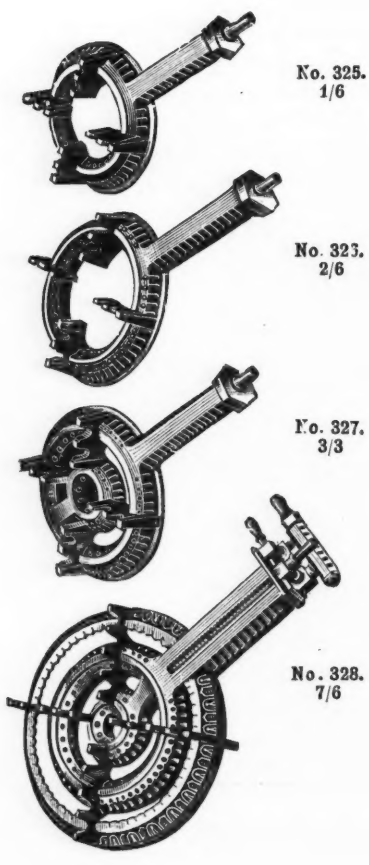
NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week negotiations have been going on for a conference between the Corporation of Aberdeen and the Directors of the Great North of Scotland Railway Company, with a view to settling the difference between them regarding the proposal of the Railway Company to take a portion of the site of the Corporation gas-works for an extension of their goods yard. It is eminently a matter for agreement; and if the parties can agree in Aberdeen it could be done cheaply. But it is more than likely that London Counsel and Agents will seek to have their finger in the pie, and that, consequently, there will be no binding settlement till the parties are all at Westminster again.

It is this assumption of superiority on the part of Parliamentary Counsel and Agents which really gives form to those who are at the present time agitating for the localization of inquiries into Private Bill procedure. The evil is not, however, confined to the parliamentary forum. It is rampant in every judicial area in the United Kingdom. I know quite well the struggle which many of the Law Agents resident in Edinburgh, and practising in the Court of Session, maintain to get litigations conducted in the Supreme Court rather than in the local Sheriff Courts. Therein I find an instructive lesson in the matter of the reform of Private Bill procedure. We have local inquiries in civil actions in Scotland, in the Sheriff Courts; but when a local agent loses a case, and consults his Edinburgh correspondent, an appeal to the Court of Session is almost invariably urged, and thereby both the local man and the Edinburgh man profit. Would it be different in parliamentary matters? Suppose a local inquiry were held upon a Bill, is it not more than probable that the losing side would appeal direct to Parliament? And if they did, the whole matter would require to be fought over again before a Parliamentary Committee; for it is vain to suppose that Parliament would ever divest itself—if, indeed, it has the power to do so—of the



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right of ultimate decision. There are many undoubted grievances, probably amounting to hardships, in the working of the present system. I am not concerned, particularly in this column, with the finding of a remedy for them, because that task has baffled far more powerful minds than mine. What I maintain, and have always held, is that the method proposed would not lead to a lessening of the costs of parliamentary inquiries. It would lead to the creation of a new State Department, with a habitation—of course in London—and a staff of highly paid officials; and while the charges for all this would be borne by the Imperial Exchequer, the Exchequer Office would, in turn, charge high fees for the business done, in order to recoup themselves. Then, as I showed a fortnight ago, the costs of Counsel and witnesses would, in contested cases, be higher, instead of lower, than they are just now. At present uncontested cases can be carried through at little cost. There is no complaint with regard to them; it is only the costs of contested cases which are grudged. Those who are supporting the change which is embodied in the Private Bill Procedure (Scotland) Bill, now before Parliament, got quite a stomachful of their favourite dish at a conference in Edinburgh on Wednesday, which was promoted by the Edinburgh Merchant Company. I have looked at the published list of those taking part in the conference, and I find in it an interesting commentary upon the remark of the Chairman to the effect that there was a public opinion on behalf of the Bill in Scotland. The list contains representatives from nearly, if not all, the Law Agents' Societies in Scotland, most of the Chambers of Commerce, and a number of Town Councils. The Corporations of Edinburgh, Glasgow, Dundee, and Aberdeen, were not represented, neither was the Glasgow Chamber of Commerce, which is by far and away the most important of all the commercial bodies in Scotland. Nor was there a single representative of any Railway Company, County Council, or other body who conduct their business themselves, and who are not under the domination of the faddists or wire-pullers that buzz about Chambers of Commerce and such like moribund institutions. It was stated that between 1886 and 1891 Scotland spent £606,000 in promoting parliamentary measures—an average of more than £100,000 per annum; and that there were about 125 Bills dealt with, making the average more than £5000 per Bill. But it was further stated that of the total sum, £444,000 was spent by railway companies. The railway companies, who spent two-thirds of the whole amount, appear not to be in favour of the proposed change; and the significance of the non-participation of them and others in the agitation, is that it lends colour to the view that the public opinion which this conference was intended to voice is an altogether manufactured public opinion, which I believe it is. Sir Andrew M'Donald, the ex-Lord Provost of Edinburgh, in illustration of the unfairness of the present procedure, pointed out that the Bill of the Edinburgh Corporation for the erection of new gas-works at Granton involved a capital expenditure of nearly three-quarters-of-a-million, while the present Bill of the Edinburgh Water Trust will involve an expenditure of about £40,000. Yet, owing to the nature of the opposition to the Water Bill, the cost of it would far exceed that of the Gas Bill. That is no argument at all. I doubt not but that, if the Gas Bill inquiry had been held in Edinburgh, there would have been more opposition to it than there was, because of the ease with which it could have been put forward. But over and above that view, the Gas Bill was founded on reasonable propositions, whereas, to say the least of it, the Water Bill has been promoted to enable the Trust to escape from the necessity of purchasing minerals, and, in the nature of things, there was bound to be a powerful opposition. The agitation is a scramble among the lawyers for the big fees which go in parliamentary inquiries. The public, who have to find the money, would have to find it all the same though the inquiry were in Scotland, as they do when it is in London. It is only a question of which pocket it is to go into, and that is not a question of principle, or of patriotism either, because many Scotchmen practise at the Parliamentary Bar, as Counsel or Agents.

A grievance which, I believe, is not singular, but is unusual, was experienced by the representatives of the Stirling Gas Light Company and the Stirling Corporation, is illustrated by the following announcement which was made on Tuesday: "The Stirling Gas Bill came before a Committee of the House of Commons yesterday, presided over by Sir Henry Fletcher. Counsel for the Stirling Gas Company made an application to the Committee to postpone until after the Whitsuntide recess. The Chairman pointed out that he had announced on Friday the Committee's intention to send the Bill to a new Committee after Whitsuntide, because one of the members desired to be relieved, but that later on parties representing the Gas Company made an application to the Committee to have the Bill proceeded with at the end of the group. There was a good deal of discussion; but in the end the Committee agreed to send the Bill to a new group after Whitsuntide, the Corporation of Stirling, who oppose the bill, raising no objection, but pointing out that if the arrangement announced by the Chairman had been adhered to, there would have been no occasion for the unnecessary expense of summoning witnesses to London." This is not to be held to be one of the drawbacks of the present method of conducting Private Bill inquiries, because, with the aid of the telegraph, it ought to have been quite possible to have avoided the expense which was incurred.

The financial year of the Edinburgh and Leith Gas Commission closed on the 15th inst. The result of the working is not known; but according to the latest reports, there is likely to be an increased output of a little over 30 million cubic feet of gas, as compared with the output in the preceding year. It will be observed from the Parliamentary Intelligence that the Bill of the Commissioners for the erection of new gas-works at Granton, received the Royal Assent on Monday. On the same day the Commissioners had a meeting; and in anticipation that the Bill would become law that afternoon Bailie Kinloch Anderson congratulated the Commissioners upon their having got statutory power for the new works with so little opposition. There was submitted a report by Mr. Herring on the visit which he paid, in company with Mr. Corbet Woodall, to nine gas-works in Hanover, Berlin, Frankfort-on-Main, Colne, Aix-la-Chapelle, Brussels, and Antwerp. He considered, he reported, that the visit had been a profitable one from a technical point of view. He commented upon the extended use of incandescent gas lighting. In Berlin, in particular, and the surrounding communes, not an ordinary gas-light burner is in existence; the whole place being illuminated either by arc

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electric lamps or incandescent gas-lamps. In Brussels incandescent gas lighting might be said to be almost universal for shop lighting; and a very fine display was made in the majority of instances. Their Bill having now passed, it was a foregone conclusion that they should be fully empowered, within a few months, to proceed with the construction of new works; and, in the interim, he proposed completing his series of visits to gas-works, so as to enable him to immediately proceed with the final details of the work. He thought it would be wise to have some of the Commissioners to accompany him, thereby enabling them to satisfy themselves as to the general utility and the relative and comparative advantages of the various systems which might he inspected. The Commissioners adopted Mr. Herring's report, and remitted to the Works Committee to arrange as to the deputation which is to visit places both in England and on the Continent.

The annual financial statement of the Glasgow Corporation Water Department, which was submitted by Mr. Guthrie at a recent meeting of the Town Council, showed an income and expenditure for the year from May 31, 1898, to May 31, 1899, estimated at £151,323. Making allowance for deficiency in hydraulic and river supply works and for interest on borrowed money, and a probable credit balance of £36,382, the total was brought up to £243,694. To meet this there was an estimated revenue of £202,411 from rates, &c., to which was added the year's estimated surplus of £40,863. For the hydraulic power supply the expenditure was estimated at £6631, to meet which there was a sum of £5043, and a balance of £1588 carried to the debit of the Corporation water-works account. The river supply works expenditure was estimated at £5231, with a revenue from meter supplies and grazing rent of £3752. To meet the deficiency, a sum of £1479 was carried to the debit of the water-works account. The Committee recommended that the present rate should remain unaltered—the domestic rate at 6d. in the pound within the area of compulsory supply, and 10d. in the pound beyond; and the public water-rate at 1d. in the pound. Mr. Guthrie said it might be thought that at this time a reduction of the domestic water-rate should be faced. They had made a substantial reduction on the various traders' and manufacturers' rates; and the Committee asked the Council to bear with them for another year. On behalf of the Finance Committee, he might state that next year the city of Glasgow would have 1d taken off the domestic water-rate if the forecast proved to be correct. They would then not only have the purest and most ample, but also the cheapest water supply in the world. In regard to the hydraulic supply works, he would only say that, while in the current year they anticipated a loss of £2772, the estimate for 1898-9 brought it down to £1588. As regarded the river supply works, a surplus was apparent for the first time in the year's estimates. The reductions in manufacturers' rates, it was calculated, would amount to about £7000. The estimates were adopted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 28.

Sulphate of Ammonia.—The demand for prompt delivery has been well sustained; and there has been a further slight improvement in values—the closing quotations being £9 5s. per ton f.o.b. Hull; and £9 7s. 6d. per ton f.o.b. Liverpool and Leith. There has been keen competition among middlemen for ready parcels; but, owing to lower speculative quotations for delivery over the summer months, direct buyers have rather cooled down. There is nothing special to report for delivery further ahead; but makers' ideas are about £9 10s. per ton.

Nitrate of Soda is firm at 7s. 6d. per cwt. for fine quality on spot.

LONDON, *May* 28.

Tar Products show a flat market all round. The long looked-for increased demand for anthracene seems as far off as ever; and outside makes are being hawked about at very low prices—indeed, at such prices as would barely pay the cost of extraction and packages. A large parcel of "B" anthracene has been offering all round at 3d. per unit. Benzols keep flat; and very little new business is being done. Dealers are all decrying it, and speak of lower prices. Pitch is again disappointing; and, though considerable shipments are going on against contracts, and stocks are not unusually high in any quarter, its tendency is rather to lower figures again. There is nothing interesting to record in any of the other products; and the average quotations during the week may be summed up as follows: Tar, 11s. 6d. to 14s. 6d. Pitch, 21s. 6d., east coast; 18s. 6d., west coast. Benzols, 90's, 1s.; 50's, 1s. 1d. Toluol, 1s. 3½d. Solvent naphtha, 1s. 3d. Heavy naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 4½d. Creosote, 2¾d. Heavy oils, 50s. Carbolic acid, 60's, 2s. Naphthalene, 52s. 6d.; salts, 32s. 6d. Anthracene, nominal, "A," 5d.; "B," 4d.

Sulphate of Ammonia continues active; and quotations are more uniform at the various ports than they have been for some time—£9 5s. to £9 7s. 6d., less 3¼ per cent., being the general quotation. There is a better feeling in regard to forward delivery, especially as it is anticipated that there will be heavy short shipments of nitrate, owing to the war.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A steady tone is being maintained in the coal trade; and although there is a slackening off in inquiries for house-fire purposes due to the season of the year, the demand generally is still keeping pits on practically full time. Prices for house-fire qualities remain without quotable change; and the season is now so far advanced that there is little or no probability of any material easing down during the summer, while as regards the usual contracts which dealers give out during the ensuing month, it is practically certain that some substantial advance on last year's prices will have to be paid. With the activity prevalent throughout the iron trade and other of the principal coal-using industries, there is a full average demand for all descriptions of steam and forge coals, and these are firm at the slightly advanced rates which have been ruling recently. The increased quantity of round coal which has been screened of late, has necessarily caused some classes of slack to be more plentiful on the market, and here and there surplus lots are

JOSEPH AIRD
GREAT-BRIDGE,
STAFFORDSHIRE.
HIGHEST QUALITY
TUBES AND FITTINGS
GAS, STEAM, WATER, GALVANIZED TUBES and FITTINGS in all Sizes.
LARGE TUBES FOR COLLIERIES.
Illustrated Price Lists on Application.
LONDON OFFICES: 46, QUEEN VICTORIA STREET, E.C.

pushed for clearance sales at low figures; but the average pit quotations are unaltered. With regard to contracts that are now being renewed, the question of prices for the ensuing season was under consideration at a meeting of Lancashire colliery owners held last week. Although the meeting did not commit itself to any definite course, a resolution was passed that a substantial advance on last season's prices ought to be insisted upon, and in accordance with this, representatives of collieries are generally holding out for higher prices than those at which contracts were taken last year. Negotiations are in progress for the usual important locomotive fuel contracts, upon which colliery owners are attempting to secure a substantial advance on the low figures they had to take twelve months ago. Gas-coal contracts are being secured, in some cases, at advances of 6d. to 9d. per ton; but no great weight has yet been placed. On other classes of fuel for general manufacturing requirements, advances ranging from 3d. up to 9d. are being quoted on renewal contracts.

Northern Coal Trade.—There is a strong demand for coals this week, partly because the opening of the Baltic allows shipments to be larger, and partly because the holidays also slightly lessen the output, and give a fuller demand in anticipation. In best Northumbrian steam coals, the quotation is about 13s. per ton f.o.b.; steam smalls being about 4s. 9d. per ton—so that, though very steady at the moment, the price is falling towards more normal quotations. The demand is strong, and there is a large export to the Northern ports in progress. In bunker coals, there is also a very large demand; but the range of prices is not much changed—the general quotation being about 8s. 6d. per ton f.o.b. Regarding gas coals, there is as yet no settlement of the large Newcastle gas-coal contracts; the difference in price between the expectations of buyers and sellers being much greater than usual. For contracts over the shipping season, the quotation now is about 8s. per ton f.o.b.; and for the present period of the year the demand is fairly good, heavy exports partly making up for the comparatively low local consumption. It is expected that in a few weeks the home use of gas coals will be enlarged again. There is little or no change in the condition of manufacturing coals; and household coals continue very dull at this season of the year. The coke trade is brisk, and the demand is very full for local use. Gas coke is steady; and there is some rumour of shipments to Southern ports from the Tyne. Prices show no alteration.

Scotch Coal Trade.—Declining, both in volume and in price, is about all that can be said about the coal trade in Scotland. The prices are affected by what is believed to be the approaching end of the Welsh trouble. As to the volume, it is anticipated that it would be much larger were it not for a scarcity of ships to carry cargoes away. It is expected that, although prices are coming down, they will not get so low as they were during the winter. The quotations are: Main, per ton, f.o.b. Glasgow, 8s. to 8s. 3d.; ell, 9s.; and splint, 8s. 3d. to 8s. 9d. The shipments for the week amounted to 204,421 tons—a decrease when compared with the preceding week, of 43,904 tons, but an increase when compared with the corresponding week of last year, of 48,294 tons. For the year to date, the total shipments have been 3,181,909 tons—an increase upon the corresponding period of last year of 417,010 tons.

The Barrowfield Iron-Works, Limited, Glasgow, have secured the contract for the construction of a new lower lift of a gasholder which is to be telescoped, at Johnstone, in Renfrewshire. The work is to be done to plans prepared by Mr. J. M'Gilchrist, of Dumbarton.

The first of the series of exhibitions of their new burner which, as already announced in the "JOURNAL," have been organized by Mr. J. H. Sheldrake for the Welsbach Company, took place in the Colston Hall, Bristol, from Monday to Wednesday last week; the second being opened in the Masonic Hall, Birmingham, on Thursday, by Alderman Pollack, the Chairman of the Gas Committee of the Corporation. Both exhibitions were well attended. Similar exhibitions have been arranged for as follows: Cardiff, June 6 to 8; Manchester, June 8 to 10; Liverpool, June 13 to 15; Sheffield, June 15 to 17; Belfast, June 21 to 23; Leeds, June 22 to 24; Glasgow, June 28 to 30; Newcastle, June 29 and 30 and July 1; Edinburgh, July 5 to 7.

Exhibitions of gas appliances have lately been held by the following firms: The Cannon Hollow-Ware Company, Limited, at Bideford, with cookery demonstrations by Mrs. Marshall; also at Barnstaple, Fleetwood, and Swansea. The Davis Gas-Stove Company, Limited, at Rotherham. Messrs. Fletcher, Russell, and Co., Limited, at Bedminster and Rotherham. Messrs. Richmond and Co., Limited, at Birkenhead, Edinburgh, Grantham, Kingstown, Leeds, Rotherham, and Stone; cookery lectures being delivered by Mrs. Bradshaw, Mrs. Middleton, Miss E. Dennell, and Miss L. Richmond. The firm have also exhibited at Bridgwater, Bury St. Edmunds, Canterbury, Wanstead, and Woodford. Messrs. W. Parkinson and Co., at Higher Openshaw, with lectures by Miss Edith Sanderson.

GWYNNE & BEALE'S

PATENT

GAS-EXHAUSTERS AND STEAM-ENGINES

FOR FULL PARTICULARS, APPLY TO THE MAKERS:

GWYNNE & CO.,

Telegrams: "GWYNNEGRAM, LONDON."

HYDRAULIC AND GAS ENGINEERS

Telephone No. 95 Holborn.

(Late Essex Street Works, Victoria Embankment, London),

BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKELMANN'S "VOLCANIC" and "VOLCUM" CEMENT. Fire Resistance up to 4500° Fahr. In use in Gas-Works all over the World.

ANDREW STEPHENSON,
182, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

[For Illustrated Advertisement, see May 3, p. 1029.]

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHURIC ACID for Sale.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.

READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS and WAKEFIELD.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E., and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "SADLER, MIDDLESBROUGH."

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 1228 last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

CHEAP BENZOL.

AT the present low Prices, Benzol is very much the cheapest Enricher for Gas.
Apply to SADLER AND CO., MIDDLESBROUGH.

TO GAS AND WATER OFFICIALS.

SPECIALLY favourable terms for Cycles. First-Class Workmanship and Material guaranteed. Art Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

WATER-GAS PLANT.

ENGINEERS contemplating the above are invited to communicate with the Advertiser, who is prepared to give every assistance in designing Plant of any capacity.
J. L. FEATHERSTONE, 30, Amesbury Avenue, STREATHAM HILL.

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OLD Retorts made equal to new by repairing them with CROWTHER'S PATENT STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Can be used in Hot or Cold Retorts; and "A1." for Mouthpiece Joints. Satisfaction Guaranteed.
CROWTHER, Practical Retort Setter, Manor Street, HUDDERSFIELD.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

GAS-FITTER wants Situation. Used to Compo. and Iron, Gas Cookers and Coin Meters. In last situation 10½ years. Excellent references.
Apply, by letter, to No. 3066, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SOUTH AMERICA.

A GENTLEMAN about to travel over South America (25 years' residence there) would be willing to REPRESENT TWO OR THREE FIRMS with the object of establishing Agencies. Highest References.
S Box 1060, SELL'S, FLEET STREET, E.C.

WANTED, Retort Setters.
Apply to the LEEDS FIRE-CLAY COMPANY, LTD., Engineering Department, Wortley, near LEEDS.

WANTED, a Manager for Gas-Works in Ireland. Make about 10 millions. Salary £150, with free House, Garden, Coal, and Gas.
Apply, by letter, to No. 3065, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OUTDOOR INSPECTOR.

WANTED, an Outdoor Inspector accustomed to Coin Meters, Stoves, Fittings and general supervision of Fitters.
Apply, by letter, to No. 3067, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Smart and Steady Young Man about 20, who has been used to Gas-Works (and willing to make himself generally useful) for Inspecting and fixing Meters and Cooking-Stoves.
Apply, by letter, with Particulars, to No. 3069, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Carbon in 4 Ton Lots, or more.
State Price, f.o.r. at nearest Station, to No. 3031, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Small Rotary Gas-Washer
State full Particulars, together with lowest Price, to No. 3068, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Four Purifiers, 7 feet square, 3 ft. 9 in. deep, with two sets of Grids, Covers, Lifting Gear, twelve 8-inch Valves and Connections, all complete.
Apply to the MANAGER, Gas-Works, ARDROSSAN.

FOR SALE—Purifiers, Sets of four 10 feet square and four 12 feet square. Sold in sets of twos, with 12-inch Bye-Pass Valves, &c. Sound and perfect. Will be sold cheap to an immediate Customer.
Address No. 3064, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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FOR SALE—Minutes of Proceedings from 1872-3 to 1896-7; 95 Volumes, in good condition.
Offers to be addressed to No. 3063, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

EXHAUSTERS for Sale by Waller, Donkin, and other Makers. New and Second-hand, overhauled, and in perfect working order. Most sizes from 2000 to 50,000 cubic feet per hour ready for delivery.
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE, Cheap—The under- mentioned GAS PLANT:—
2 PURIFIERS, 5 ft. square by 4 ft. deep.
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Apply to SAML. WHILE AND SONS, 60, QUEEN VICTORIA STREET, E.C.

FOR SALE, owing to Extensions—One 250,000 Feet KIRKHAM, HULETT, and CHANDLER WASHER, with Vertical Engine, also two CORNISH BOILERS, 12 feet long, 4-feet shell, 2-feet tube, fitted with Meldrum's Blowers. Can be seen by appointment.
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GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

TENDERS FOR COAL.

THE Directors of the Petersfield Gas Company, Limited, are prepared to receive TENDERS for the supply of about 1000 Tons of GAS COAL required by them during the Year ending the 30th of June, 1899.
Further Information can be obtained from the undersigned.
Sealed Tenders, endorsed "Tender for Coal," to be delivered on or before June 11.

W. C. BURLEY.
Petersfield.

CITY OF CARLISLE.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the COAL and CANNEL required at their Works during One Year from the 1st of July next.
Tenders to be delivered to the undersigned not later than June 6, 1898.
Forms of Tender and other Particulars on application.

C. B. NEWTON,
Engineer and General Manager.
Gas-Works, Carlisle,
May 20, 1898.

CITY OF CARLISLE.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the surplus TAR produced at their Works for a period of One Year from the 1st of July next.
Tenders to be delivered to the undersigned not later than June 6, 1898.
Further Particulars can be obtained on application.

C. B. NEWTON,
Engineer and General Manager.
Gas-Works, Carlisle,
May 20, 1898.

HAWORTH URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council are prepared to receive TENDERS for 600 yards of 9-inch plain SOCKET PIPES, 9 feet long (each Pipe not to weigh more than 4 cwt.), delivered at Oxenhope Station.
Tenders, endorsed "Pipes," to be sent to me not later than the 3rd of June next.
The Council do not bind themselves to accept the lowest or any Tender.

By order,
WM. ROBERTSHAW,
Clerk to the Council.
Burlington Chambers, Keighley.

HAWORTH URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council are prepared to receive TENDERS for a DOUBLE-LIFT GASHOLDER.
Plans and Specification may be seen at the Gas-Works on application to Mr. J. H. Whittell, Gas Manager.
Tenders, endorsed "Gasholder," to be sent to me not later than the 3rd of June next.
The Council do not bind themselves to accept the lowest or any Tender.

By order,
WM. ROBERTSHAW,
Clerk to the Council.
Burlington Chambers, Keighley.

NEWARK GAS COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, free on Rail G.N.R. or M.R. in Purchaser's Tanks for One Year from the 1st day of July, 1898.
Terms: Cash monthly.
Further Particulars can be obtained on application to the undersigned, to whom sealed Tenders are to be sent on or before the 16th day of June next, marked on the outside "Tender for Tar."
The Directors do not bind themselves to accept the highest or any Tender.

By order,
F. B. FOOTTIT,
Secretary.
Newark, May 27, 1898.

NEWARK GAS COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR produced at their Works for One Year from the 1st day of July, 1898, at per degree Twaddel (Temperature 60° Fahr). The Liquor to be not less than 5° in strength.
Terms: Cash monthly.
Further Particulars can be had on application to the undersigned, to whom sealed Tenders, marked on the outside "Tender for Liquor," are to be sent on or before the 16th day of June next.
The highest Tender will not be necessarily accepted.

F. B. FOOTTIT,
Secretary.
Newark, May 27, 1898.

COUNTY BOROUGH OF WEST BROMWICH.
(GAS DEPARTMENT.)

TO COLLIERY PROPRIETORS.

THE Gas Committee are prepared to receive TENDERS for the supply of 23,000 Tons of GAS COAL. Also 700 Tons of CANNEL COAL for use at their Works, Albion, West Bromwich.
The Committee do not bind themselves to accept the lowest or any Tender; and they reserve to themselves the right to divide the contract between several Firms.
Forms of Tender may be obtained upon application to Mr. Thomas Glover, Manager of the Works.
Sealed Tenders, properly endorsed, to be sent to me not later than Monday, the 13th of June.

By order,
THOS. HUDSON,
Secretary.
Town Hall, West Bromwich,
May 25, 1898.

CRYSTAL PALACE DISTRICT GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the above Company invite TENDERS for the whole or any portion of any surplus TAR—say, 1 million gallons—made at these Works during the Year from the 1st day of July next to the 30th of June, 1899. The Tar can be taken by Road or Rail from the Company's Siding.

Price to be quoted both per gallon and per ton.

Tenders to be addressed to the Chairman of the Company, and forwarded to these Offices on or before the evening of the 9th day of June next.

Conditions of Contract and any further Information may be obtained on application.

The Directors reserve the right to accept the Tender of any one or more Contractors, at their option, and do not bind themselves to accept the highest or any Tender.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, London, S.E.,
May 23, 1898.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of

1. BRUSHES.
2. INDIA-RUBBER GOODS.
3. BRASS MAIN COCKS.
4. OILS, PAINTS, &c.
5. BRASS LAMP FITTINGS.
6. WROUGHT-IRON STEAM TUBES AND FITTINGS.
7. SULPHURIC ACID.
8. OXIDE OF IRON.

And for the purchase of

1. GAS CARBON.
2. BRIMSTONE.
3. SPENT OXIDE OF IRON.

For the Twelve Months ending the 30th of June, 1899.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, Engineer, Gas-Works, Halifax.

Tenders, properly endorsed, to be sent to the undersigned, before Ten o'clock a.m., on Wednesday, the 8th of June, 1898.

The person whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

By order,
KEIGHLEY WALTON,
Town Clerk.

GOOLE URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

TENDERS FOR GAS COAL.
TENDERS FOR STEAM COAL.
TENDERS FOR AMMONIACAL LIQUOR.

COAL.

THE above Council are prepared to receive TENDERS for the supply of from 5000 to 6000 Tons of best screened GAS COAL, and 600 to 700 Tons of best screened STEAM COAL, in such quantities as the Council may direct from time to time, for One Year from date of Contract.

Gas Coal to be delivered free at the Lancashire and Yorkshire Siding in Bridge Street, the North-Eastern Railway Station, or by Boat or Compartments on the Wharf of the Aire and Calder Canal at Goole.

Steam Coal to be delivered alongside the Rawcliffe Pumping-Station, near Goole, on the same Canal.

AMMONIACAL LIQUOR.

Tenders for the surplus Liquor made during the Year from June 1, 1898, the same to be made either at a fixed price per ton, or on the Sliding-Scale regulated by the price of Sulphate.

Tenders, endorsed and sealed, to reach George England, Clerk to the Council, Exchange Buildings, Goole, before the 15th day of June next.

The Council do not bind themselves to accept any Tender.

Further Information and Form of Tender may be had, on written application only, to the undersigned.

By order of the Committee,
MATT. DUNN, M.Inst.M.E.,
Engineer and Manager.

Engineer's Office, Exchange Buildings,
Goole, May 21, 1898.

GOOLE URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

GAS APPARATUS.

THE above Council are prepared to receive TENDERS for the following Apparatus:—

(1) Six Beds of RETORTS on the Regenerative Principle, complete with all Excavating, Foundations, and Connections.
(2) STEEL ANNULAR CONDENSER, Eight Stacks, 25 feet high, 3 ft. 6 in. and 2 ft. 6 in. Tubes, 14-inch Valves, Connections, and Bye-Pass.
(3) ALTERATIONS and ADDITIONS to existing Retort-House.
(4) PURIFIER SIEVES, and TEE-IRON BEARERS.
(5) EXHAUSTER, ENGINE, and CONNECTIONS, and removal of present Exhauster and Engine.
(6) NEW EXHAUSTER-HOUSE.
(7) NEW WORKS OFFICES.
(8) PHOTOMETER and TESTING APPARATUS.

Tenders, endorsed and sealed, to reach George England, Clerk to the Council, Exchange Buildings, Goole, before the 13th of June next, excepting the Tenders for Regenerative Settings and Mountings, which *must reach him (before noon) on the 6th of June*, 1898.

Further Information may be had on application to the undersigned.

By order of the Committee,
MATT. DUNN, M.Inst.M.E.,
Engineer and Manager.

Engineer's Office, Exchange Buildings,
Goole, May 21, 1898.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for 12,000 Tons of good screened GAS COAL or NUTS, or any part thereof, for delivery in equal Monthly quantities during the Year ending June 30, 1899.

Forms of Tender may be obtained on application to the Manager.

Sealed Tenders, endorsed "Tender for Gas Coal," to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned on or before Monday, June 13, 1898.

W. NORTH,
Engineer and Manager.

Gas-Works, Stourbridge,
May 21, 1898.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 12,000 Tons of Screened GAS COAL, and about 1000 Tons of good ENGLISH CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during One, Two, or Three Years, commencing July 1, 1898.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June, 1898.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1898.

SCARBOROUGH GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR, to be produced at their Works for One or more Years from the 1st day of July next.

Tenders for Liquor may be submitted either at a fixed Price per Ton or on a Sliding-Scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned, to whom sealed Tenders (duly endorsed) must be delivered not later than Noon, on Saturday, the 11th of June next.

The Directors do not bind themselves to accept the highest or any Tender.

By order of the Board,
(Signed) J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough,
Scarborough, May 18, 1898.

SELBY URBAN DISTRICT COUNCIL.

THE above Council are prepared to receive TENDERS for the following Contracts:—

CONTRACT No. 1.

For the construction and erection of a GASHOLDER 98 ft. diameter by 25 ft. deep, with Cup, and Steel Tank, 102 ft. diameter and 25 ft. 6 in. deep, together with Brick and Stone Piers and Foundations.

CONTRACT No. 2.

For the supply of MATERIALS and erection of a PURIFIER-HOUSE, 90 ft. by 32 ft; PURIFIER FOUNDATIONS; METER-HOUSE, 30 ft. by 16 ft. For the PIPING of a DRAIN with 30-inch Sanitary Pipes, 171 ft. long; laying 254 feet of 9-inch diameter open-jointed DRAIN; and BOUNDARY WALL 7 ft. high, 150 yards long.

CONTRACT No. 3.

For the supply and erection of four PURIFIERS, 16 feet square, 12-inch diameter CENTRE-VALVE and Connections and Lifting Gear.

Drawings and Specifications may be obtained of the undersigned, to whom sealed Tenders are to be addressed on or before June 6, 1898.

By order of the Council,
W. J. MOTT,
Engineer and Manager.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 4500 Tons of GAS COAL, deliveries of which are to commence the first week of July, 1898, and finish the last week in May, 1899.

Tenders to be made out for 1000 Tons of best South Yorkshire unscreened Silkstone Gas Coal, delivered in Trucks (free) at Uxbridge Railway Station, G.W.R., each Ton to contain 20 cwt., and 3500 Tons of the best description of unscreened Gas Coal from the Durham Coal-Fields, delivered by Barge (free) alongside the Company's Works, Grand Junction Canal.

Tenders are to state the names of the Pits from which the above description of Coal will be supplied; the same to be fresh wrought, and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.

Deliveries to be according to the requirements of the Company.

Tenders to be received on or before the 9th day of June next, addressed to the Chairman, Gas Company's Offices, Uxbridge, Middlesex, and endorsed "Tender for Coal."

A Form of Tender will be sent on application.

W. M. GARDINER,
Secretary.

Uxbridge, Middlesex,
May 19, 1898.

CHESTER UNITED GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Chester United Gas Company invite TENDERS for the supply of about 19,000 Tons of Screened GAS COAL during the Twelve Months commencing the 1st of July next.

Particulars may be obtained from the undersigned, to whom Tenders, endorsed "Tender for Coal," must be delivered not later than Wednesday, the 15th day of June prox.

The Directors do not bind themselves to accept the lowest or any Tender.

JAMES PYE,
Secretary.

Gas Offices: Cuppin Street, Chester,
May 30, 1898.

PONTYPRIDD URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TO TAR DISTILLERS.

THE Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Treforest Gas-Works, during the period of Twelve Months ending June 30, 1899.

Particulars can be obtained on application to the undersigned.

Tenders, under seal, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Pontypridd Gas-Works, to be delivered not later than Tuesday, June 7, 1898.

H. BARKER.

Gas-Works, Pontypridd,
May 25, 1898.

GLASGOW CORPORATION GAS.

TENDERS FOR METERS.

THE Corporation of Glasgow invite TENDERS for the supply of such METERS as may be required for Twelve Months from the 1st of June next.

Forms of Tender may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and sealed offers, marked "Tender for Meters," addressed to the Subscriber, will be received by him on or before Tuesday, the 7th of June.

The Corporation do not bind themselves to accept the lowest or any offer.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
May 27, 1898.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO TAR DISTILLERS.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR and CARBURETTED WATER-GAS TAR produced by the above Company for the Year ending the 30th of June, 1899. Coal Carbonized, about 12,500 Tons per annum.

All Tenders to state the price per Cask of 40 gallons. Cartage to and from Railway Station, Guildford, free. All Empties to be provided by Contractor.

Tenders, endorsed "Tar," to be sent to David Williamson, Esq., J.P., Chairman of the Gas Company, Guildford, on or before Thursday, June 2, 1898.

By order,
WM. TITLEY,
Secretary.

Gas Offices, Guildford,
May 18, 1898.

ROYAL BURGH OF RENFREW.

(GAS DEPARTMENT.)

THE Town Council invite Tenders for the supply, delivery, and erection of a 98 feet diameter and 21 feet deep SINGLE-LIFT GAS-HOLDER prepared for Telescoping; and the supply, delivery, and erection of a CAST-IRON TANK, 102 feet diameter and 20 feet deep.

Plans of proposed Holder may be seen and Specifications obtained (on payment of 10s. 6d., which will be returned on receipt of a *bonâ-fide* Tender) on application to the undersigned.

Offers, endorsed "Tender for Gasholder," to be lodged with John M'Laren, Town Chamberlain, on or before Friday, the 3rd of June.

The Commissioners do not bind themselves to accept the lowest or any Offer.

THOS. LIGHBODY,
Engineer and Manager.

Gas-Works, Renfrew,
May 20, 1898.

BOROUGH OF DEWSBURY.

THE Lighting Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works, Savile Town, near Dewsbury, of the following quantities of GAS COAL during a period of One, Two, or Three Years, commencing on the 1st day of July next:—

First Year: 18,000 tons Black, and 2500 tons Cannel.
Second Year: 19,000 tons Black, and 3000 tons Cannel.
Third Year: 19,000 tons Black, and 3000 tons Cannel.

Tenders must specify prices for delivery by rail, and be made on forms to be had on application to Mr. Charles A. Craven, Engineer and Manager, Savile Town Gas-Works, Dewsbury, from whom any further Information can be obtained.

Sealed Tenders, endorsed "Tender for Gas Coal," to be sent to G. Trevelyan Lee, Esq., Town Clerk, Dewsbury, not later than Saturday, the 11th of June next.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
G. TREVELYAN LEE,
Town Clerk.

Town Hall, Dewsbury,
May 28, 1898.

LEAMINGTON PRIORS GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Leamington Priors Gas Company are prepared to receive TENDERS for the supply of the GAS COAL required by them during Twelve Months from the 1st of July next.

Particulars and Forms of Quotation may be obtained from the undersigned.

Tenders must be sent in on or before Thursday, the 23rd of June, 1898.

THOMAS BERRIDGE.

Gas Offices,
Leamington Spa.

ASHFORD URBAN DISTRICT COUNCIL.

THE Gas Committee are prepared to receive TENDERS for the supply of 5000 Tons of GAS COAL between the 1st of July, 1898, and the 30th of June, 1899. Delivery to be at the Gas-Works, S.E. Railway Siding, Ashford, Kent, or on Ship at loading Port nearest to Colliery.

Forms of Tender and Information may be obtained (on application in writing only) from J. Morton, Manager, Gas-Works.

Tenders, endorsed "Coal," to be delivered on or before Five p.m., on Friday, June 3, 1898, at my Office, 11, Bank Street, Ashford, KENT.

JOHN CREERY,
Clerk.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee invite TENDERS for the TAR and AMMONIACAL LIQUOR to be produced at their different Gas Stations for a period of One or more Years, commencing the 1st of July next.

The yearly make of Tar is about 7200 Tons; and of Ammoniacal Liquor, about 2,500,000 gallons.

Particulars and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Office, Oldham, to whom Tenders are to be sent on or before Tuesday, June 7.

A. NICHOLSON,
Town Clerk.

Oldham, May 23, 1898.

COAL CONTRACT.

THE Directors of the Ossett Gas Company invite TENDERS for the supply of 7500 Tons of GAS COAL between the 1st of July, 1898, and the 30th of June, 1899, at such times and in such quantities as the Company's Manager may direct.

The quality of the Coal must be good, dry, free from Sulphur, Bats, Binds, Refuse, and Dirt.

Tenders, stating Price per Ton, delivered free at the Gas-Works, Ossett, to be sent in not later than Wednesday, the 8th of June.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
WALTER HORSNELL,
Secretary.

Ossett, May 26, 1898.

BOROUGH OF DONCASTER.

TENDERS FOR COAL.

THE Gas Committee of the Borough of Doncaster are prepared to receive TENDERS for the supply of 16,000 Tons of best Screened GAS COAL during a period commencing July, 1898, and terminating the 30th of June, 1899.

Particulars and Tender Forms may be obtained on application to John Athron, Esq., Chairman, or to the undersigned.

Tenders should be sent under seal, to the Chairman, endorsed "Tender for Coal," not later than Ten a.m., on Wednesday, the 8th of June next.

By order of the Gas Committee, who do not bind themselves to accept the lowest or any Tender.

RT. BRIDGE,
Engineer.

Gas-Works, Doncaster,
May 18, 1898.

CONTRACT FOR GAS COAL.

NOTICE is Hereby Given, that the Urban District Council of Horncastle, in the County of Lincoln, are prepared to receive TENDERS for the supply of from 500 to 1800 Tons (railway weight) of best screened SILKSTONE GAS COAL and GAS NUTS, to be delivered by the 30th of June, 1899, in such quantities, and at such times as the Council may direct.

The Coal to be sent in a dry condition, free from hards, smudge, dirt, shale, pyrites, or other impurities.

Sealed Tenders, marked "Tender for Gas Coal," to be sent to the Clerk to the Council, on or before the 13th day of June, 1893.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
S. GEO. OVERTON,
Clerk to the Council.

2, Manor House Street, Horncastle,
May 23, 1898.

CHELSEA WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY GENERAL MEETING of the Governor and Company of Chelsea Water-Works will be held at their Office, Commercial Road, Pimlico, in the County of London, on Thursday, the 23rd day of June prox., at One o'clock in the afternoon precisely, for the General Business of the Company.

The REGISTER OF TRANSFERS WILL BE CLOSED between the 11th day of June prox., and the 23rd day of June prox., both days inclusive.

By order,
G. H. GILL,
Secretary.

Office: 41, Commercial Road, Pimlico,
May 28, 1898.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 14th of June, 1898, at Twelve o'clock Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1898, and for the transaction of the General Business of the Company.

One of the Directors, Mr. John Birch Paddon, retires from office, and offers himself for re-election.

The Auditors, Mr. Robert Hesketh Jones and Mr. Thomas Guyatt, retire, and offer themselves for re-election.

The TRANSFER BOOKS WILL BE CLOSED from the 31st of May until the day of the Meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 17, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

ALDERSHOT GAS AND WATER COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 6, at Two o'clock, in Lots, 150 £10 ORDINARY SHARES in the above Company, ranking for a Maximum Dividend of 7 per cent.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

HARROW AND STANMORE GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 6, at Two o'clock, in Lots, 300 £10 "C" SHARES in the above Company, ranking for a Standard Dividend of 7 per cent.; the last Dividend on similar Shares having been 5½ per cent.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

STOCKS AND SHARES
IN THE
BARNET DISTRICT GAS & WATER COMPANY
AND
MELTON MOWBRAY GAS COMPANY.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, June 6, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

£7500 STOCK.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 20, at Two o'clock precisely, in Lots,

£7500 OF "A" ORDINARY STOCK OF THE BRIGHTON AND HOVE GENERAL GAS COMPANY,

Ranking for a Standard Dividend of 7 per cent. subject to the Sliding-Scale; the last Dividend on similar Stock having been 8½ per cent.

Particulars of the SECRETARY of the Company, at No. 5, GREAT WINCHESTER STREET, E.C., and 77, West Street, BRIGHTON, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

COLNEY HATCH GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, June 20, at Two o'clock, in Lots.

£3000 OF ADDITIONAL STOCK
OF THE
COLNEY HATCH GAS COMPANY,

Ranking for a Maximum Dividend of 7 per cent. per annum; the last Dividend on the Company's 7 per cent. Capital having been at this rate.

Particulars of the SECRETARY, at the Company's Offices, 5 & 6, GREAT WINCHESTER STREET, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

TUNBRIDGE WELLS GAS COMPANY.

ISSUE OF
£3250
FOUR-AND-A-HALF PER CENT. DEBENTURE STOCK.

THE Directors of the Tunbridge Wells Gas Company Hereby Give Notice that on Wednesday, June 8, 1898, they will be prepared to receive sealed TENDERS for £3250 DEBENTURE STOCK, to bear Interest at the rate of 4½ per cent. per annum, to be issued under the Provisions of the Tunbridge Wells Gas Acts, and in accordance with the Resolutions adopted at the Meeting of Directors held on May 11, 1893.

The Tenders must be filled up and signed by the Applicants, and delivered in sealed envelopes at the Office of the Company, 44, High Street, Tunbridge Wells, by not later than Twelve o'clock (Noon) on Wednesday, June 8, 1898.

Full Particulars and Form of Tender can be obtained on application to the Secretary.

By order,
JOHN READ,
Secretary and General Manager.

Gas Company's Office, Tunbridge Wells,
May 24, 1898.

Price 7s. 6d., Demy 4to., Limp Cloth.

THE FLOW OF GASES AND PROPORTIONING GAS-MAINS

FOUR DIAGRAMS

(WITH EXPLANATORY PAMPHLET)

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Comprising Tables, Notes, and Memoranda relating to the Manufacture, Distribution, and Use of Coal Gas, and the Construction of Gas-Works.

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London: CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, E.C.

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Highest Results in Gas, & Excellent Coke.

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½ H.P. to 20 H.P. Specially designed for Users of Small Power.

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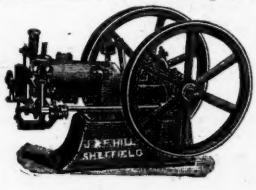

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BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
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Telegraphic Address: "PARKINSON NEWCASTLE."

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Strongly recommended where EXCESSIVE HEATS have to be maintained.

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Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
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SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.
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Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/8 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
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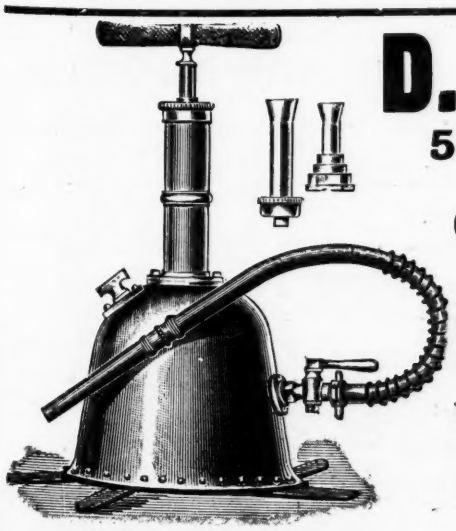
NEWCASTLE-UPON-TYNE.



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The entire Apparatus prescribed by the

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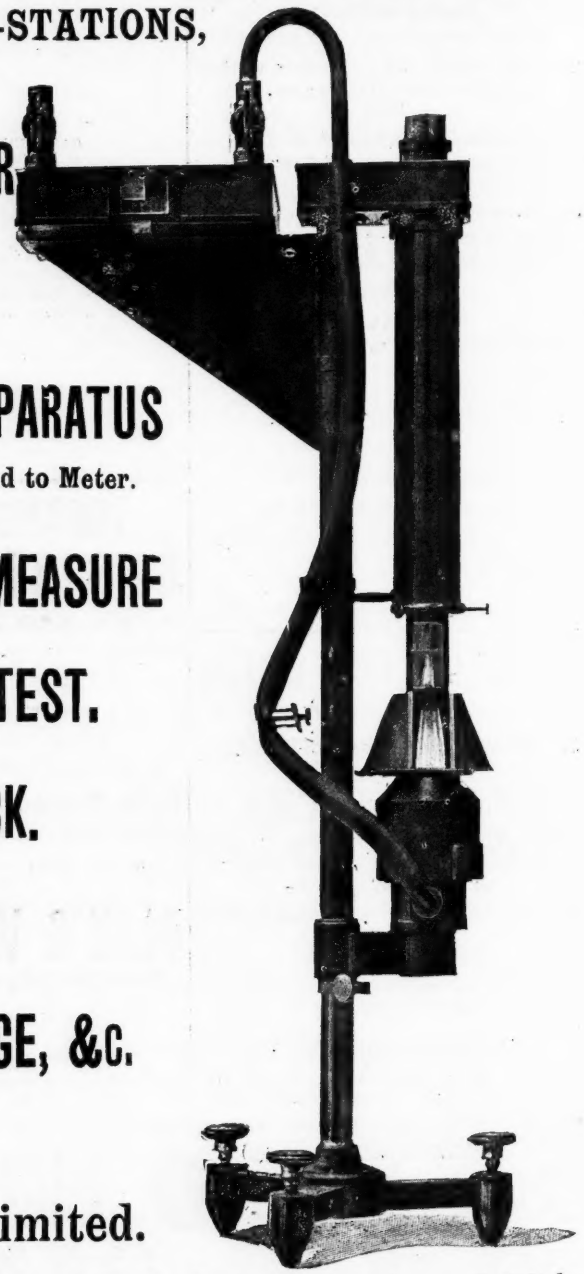
PHOTOPED, SPECIAL METER, AND GOVERNOR.



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STANDARD MINUTE CLOCK.

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GLAZED BRICKS AND PORCELAIN BATHS.

REGENERATIVE RETORT-SETTINGS.

J. FIRTH BLAKELEY & CO., GAS ENGINEERS AND CONTRACTORS, **RAVENSTHORPE, YORKS,**

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By Mr. Yuill's Principle, the maximum quantity of Gas per Retort per diem may be obtained with the minimum amount of fuel.

Gas Managers who are desirous of improving their Settings should ask for Particulars and Prices before adopting any other principle.

They give the best results, are reliable, and economical in construction.

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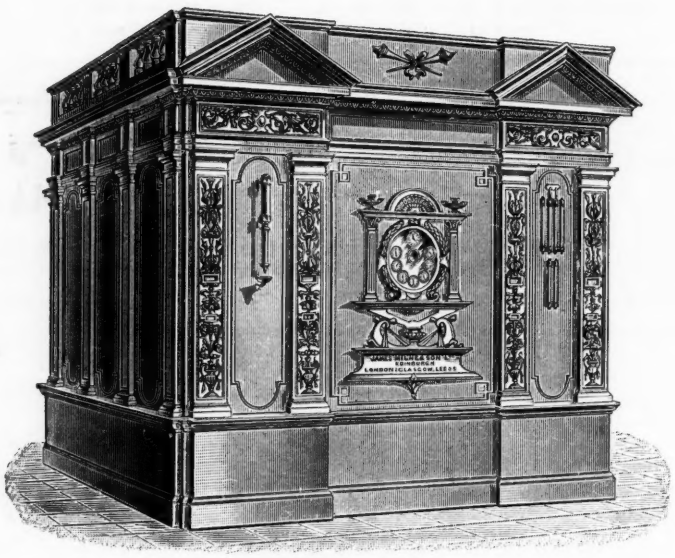

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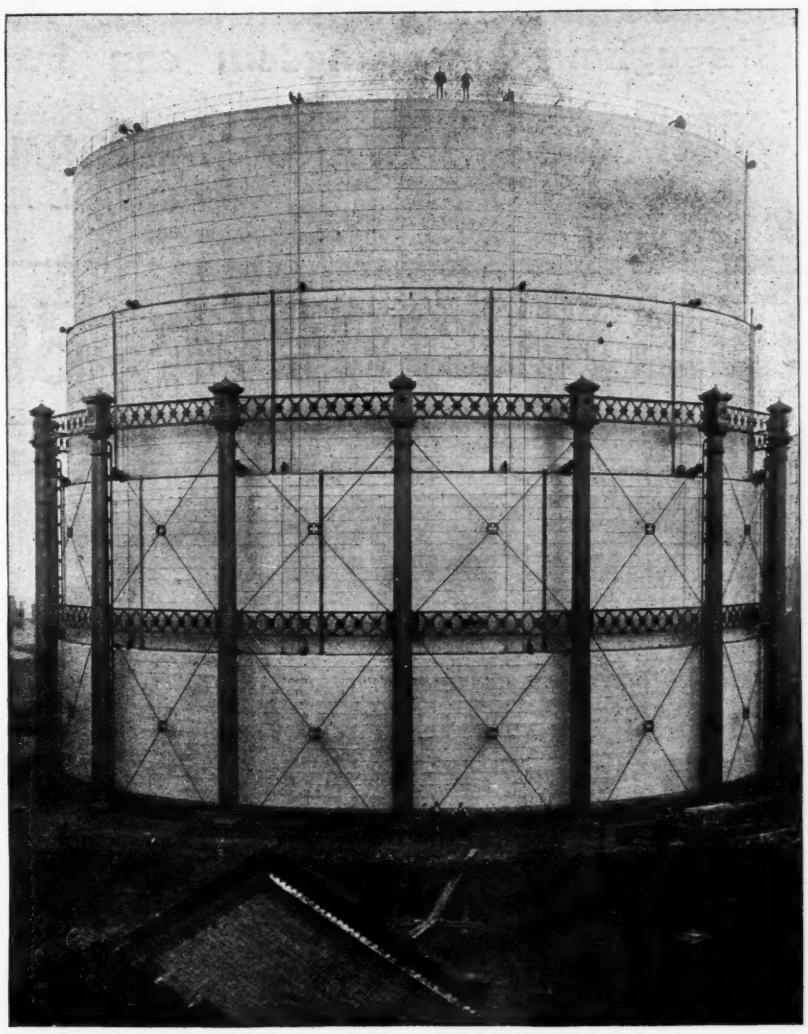

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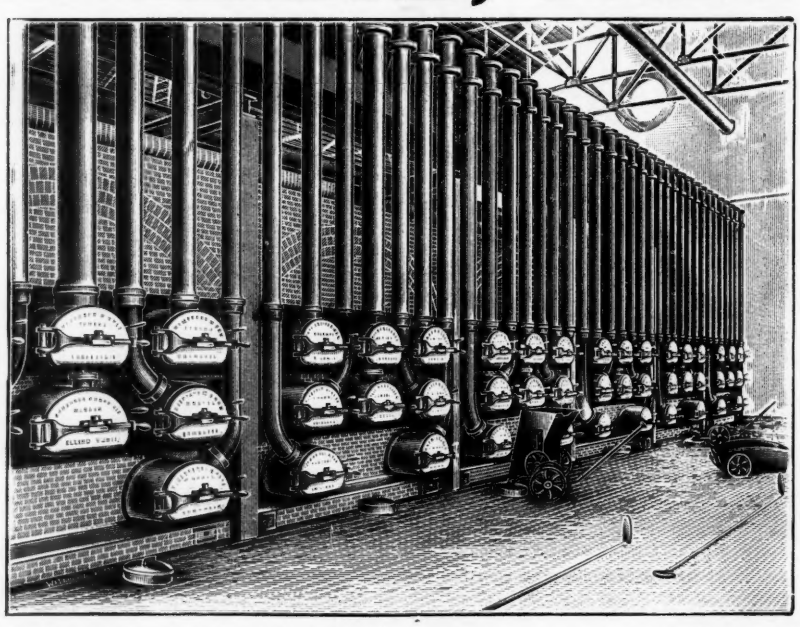

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These Articles are made from the very best Materials. They will last a very long time, and give more light than the generality of other Systems.

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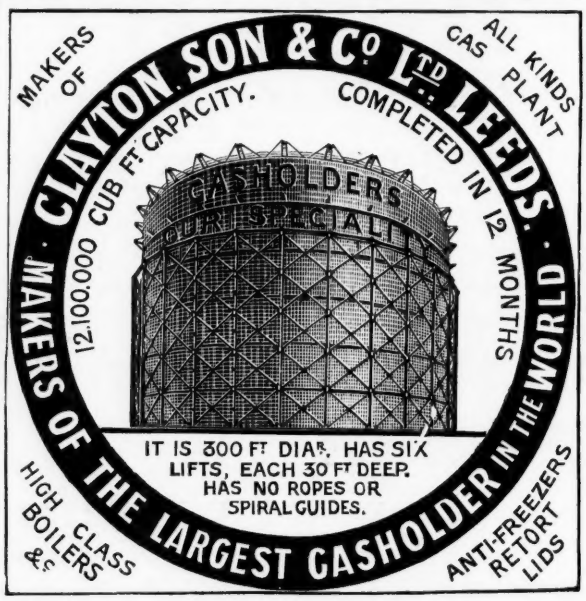
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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, May 3, p. 987.]

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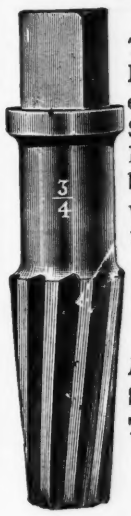

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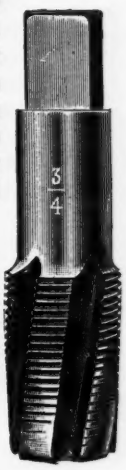

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[See also Advt. p. 1242.

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